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A. S. Burleson, Postmaster General.

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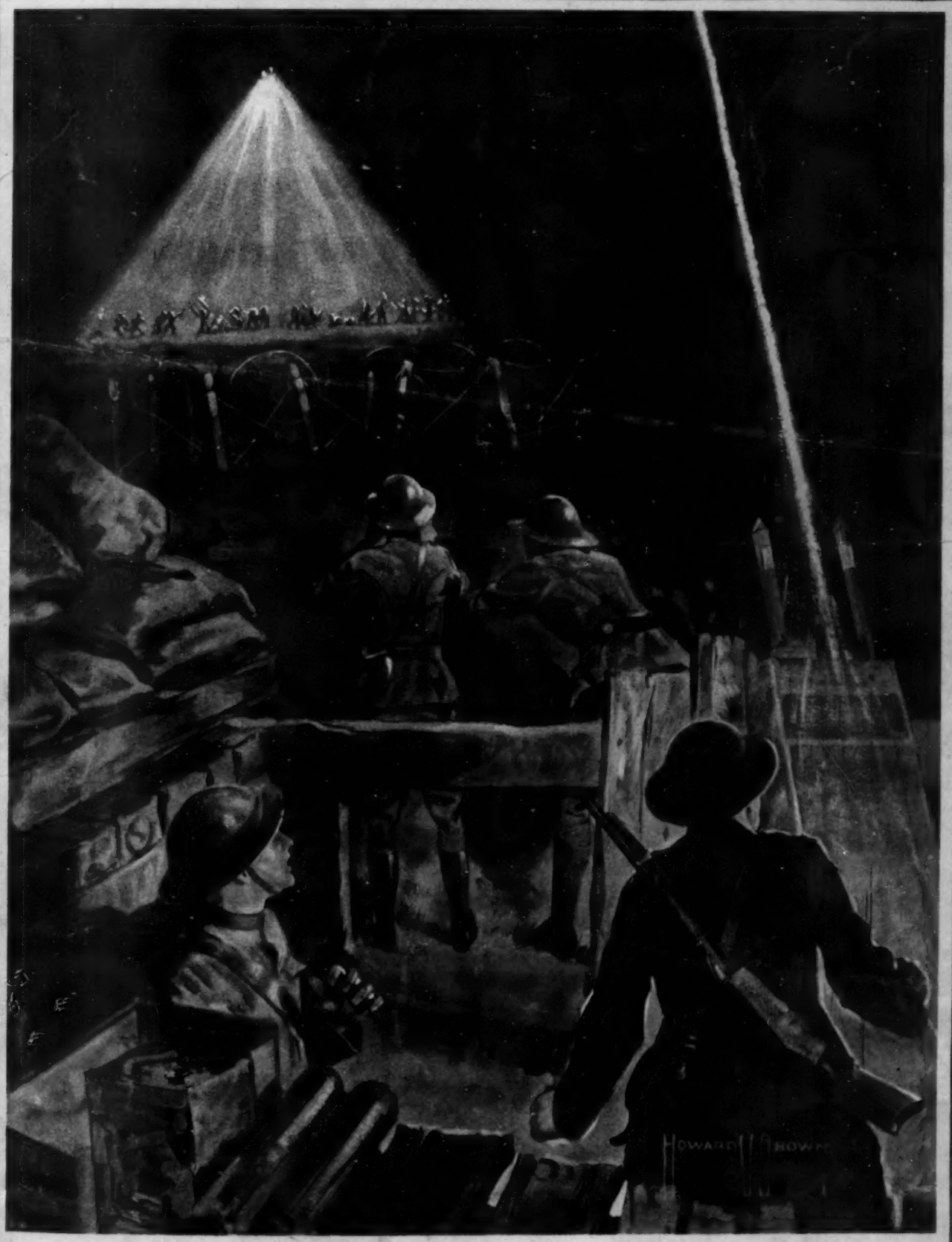
SCIENTIFIC AMERICAN



DISCOVERING A BODY OF NIGHT RAIDERS BY MEANS OF A SKY-ROCKET FLARE [See page 18]

July 6, 1918

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

THOUSANDS
of
WHITE TRUCKS

ARE purchased by users of single trucks—accepted without question because they bear the White nameplate.

Other thousands are purchased by large users who base their judgment of truck service and truck value upon years of experience with *fleets*—experience registered in exact figures of cost and performance.

Some White fleets of 100 trucks or more:

Armour & Company	235
Bell Telephone Companies	458
Atlantic Refining Company	320
Coca Cola Bottling Companies	137
Gulf Refining Company	563
Standard Oil Company of Indiana	204
Standard Oil Company of California	100
Standard Oil Company of New York	383
Swift & Company	110
Union Oil Company	162
U. S. Post Office Department	298
Yellowstone Park Transportation Co.	112
Quaker City Cab Company	100
Taxicab Association, Inc.	151

All told, there are over 2,100 fleets in active service, aggregating over 23,000 trucks, exclusive of single truck installations.

THE WHITE COMPANY
CLEVELAND

A Flood Light
Wide Spread—All-Revealing

Like Nature's Light

Yet Legal Everywhere

THE Warner-Lenz sheds a diffused light, like sunlight or like moonlight. It floods the whole scene just as Nature does, with a light that's unconfined. There are no glare-rays, no direct beam, so height is not restricted. Roadsides, turns and ditches are not left dark. That is why a million cars are Warner-Lenz equipped, by makers or by owners.

Consider These Things

Indoors and outdoors, the ideal light is diffused light nowadays. Everywhere, by indirect lighting or diffusing globes, we are substituting flood-light for the old-time piercing rays. We are imitating daylight.

The Warner-Lenz applies that ideal to your car. It is 176 lenses in one.

Piercing shaft-lights are for water, not for land. There is no need to over-light a narrow strip of road. An all-pervading light is wanted, to make the whole scene clear.

You wish to light the roadsides, ditches, curbs and turns. That means widespread light.

Upgrades should be lighted like the downgrades. Road signs should be visible — railroad crossing signs. Light rays should reach high enough for that.

You need a light which is not affected by rise and fall of the car. Or by turning of the lens in the lamp-rim. Or by a lamp bulb jarred out of focus.

The Warner-Lenz meets all these requirements. That is why it dominates the field of lawful lenses.

End All the Faults

Law and reason both condemn the glare-light. It must go. But laws do not require eccentric light, dimmed, clouded or restricted light. The Warner-Lenz is legal everywhere.

In ending glare, end all the faults of old-time headlights with it. Get away from shaft-light limitations, its straight-ahead beams and its narrow spread. Don't add new restrictions.

The Warner-Lenz gives the ideal light were there no laws to consider. Yet it is legal. It has been approved by every commission appointed under any state headlight law.

How to Decide

Glare-lights are illegal almost everywhere today. Those who have them must change lenses or else quell their lights.

But don't change twice. Get the right lens now. Ride, if you can, with a user of Warner-Lenz. After that, you will never drive without them.

Or accept the verdict of men who know. Note the list of great car makers who equip with Warner-Lenz. Take their judgment on the right lenses as you would on other features.

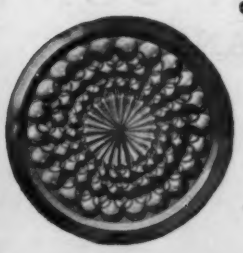
The Warner-Lenz means safety for yourself and others. Everywhere it means a lawful light. It multiplies the joy of night driving. Don't wait longer — get the right light on your car. The change can be made in a moment.

Standard Equipment on

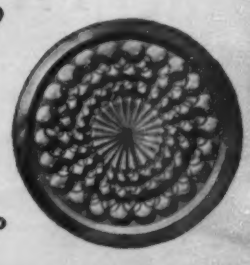
Packard
Stutz *Marmon*
Peerless
Standard 8
Fiat *White*
Daniels 8
Hal Twelve
Crawford *Ohio Electric*
Anderson
Murray *Davis*
Westcott
Cunningham
Doble Steam
Lenox *McFarlan*
Case *Moon*
Rock Falls

Motor Trucks

Vim



WARNER-LENZ



This is A. P. Warner, of the Warner Auto-Meter Fame, and Inventor of the Magnetic Speedometer

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Is Your Hauling Cost A Known Quantity?

YOU can prove the dollar earning ability of motor trucks.

First: Get the right make of truck. That secures your investment.

Second: Install an accurate, unbiased truck cost system. That eliminates the guessing that costs money. It shows up the waste, if any, in operation and maintenance. It gives you a picture of the hours each day your truck is standing idle when it should be hauling loads.

Twenty-six thousand Packard trucks are in the service of owners today. Costs kept on thousands of these trucks have confirmed the judgment of these owners.

In the national truck operating efficiency test launched by the Packard Motor Car Company, owners of Packard trucks are urged to adopt the National Standard Truck Cost System. It was originated by the Truck Owners' Conference, Inc., composed of men owning many different makes of trucks.

If you are seeking "rock-bottom" trucking costs, get the right truck and check up its work on the Standard form, supplied by any Packard Branch or Dealer.

Ask the man who owns one

PACKARD MOTOR CAR COMPANY
DETROIT, MICHIGAN

SEVENTY-FOURTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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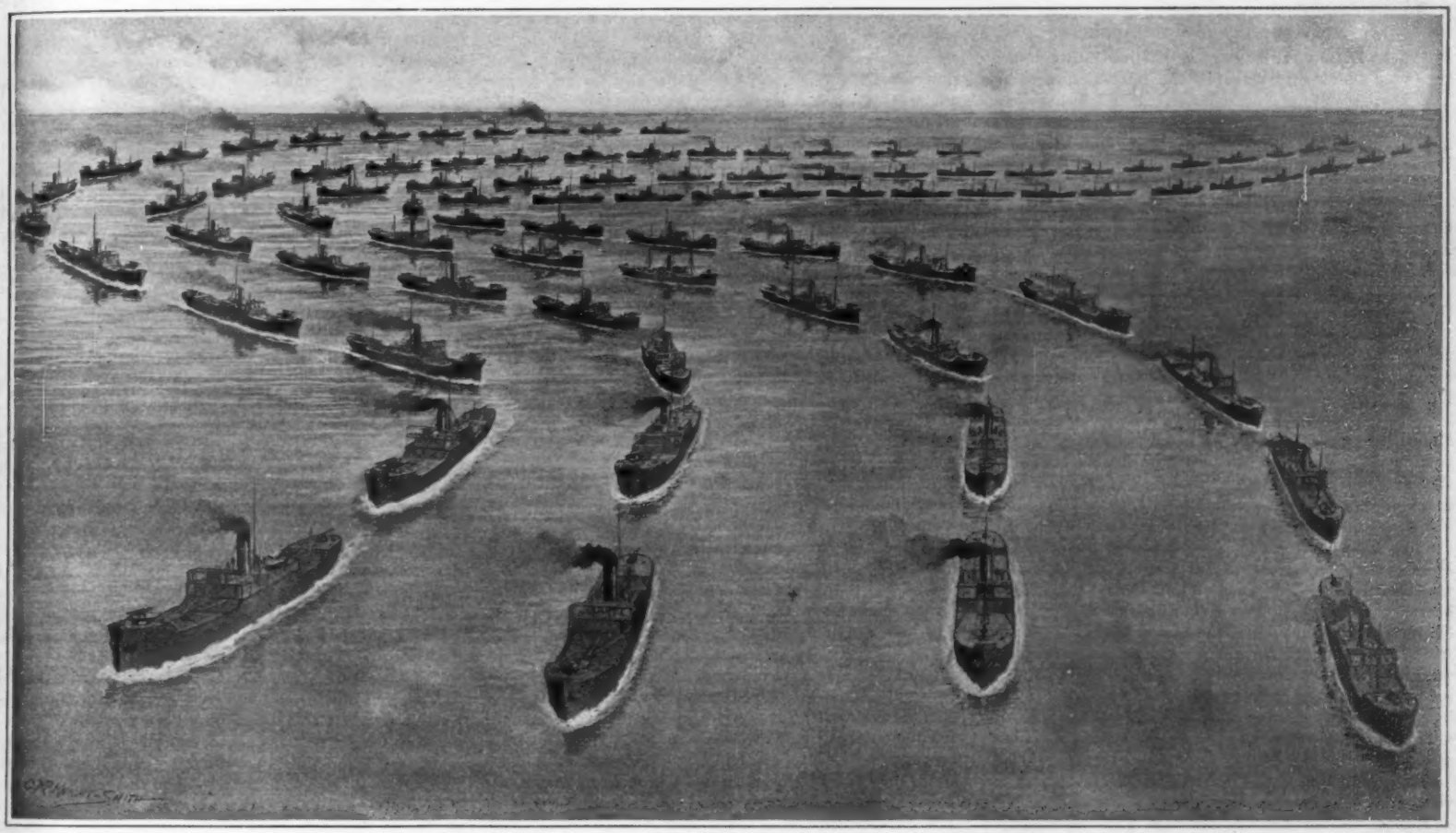

On July 4th the yards of the country launched 92 ships for the Shipping Board

July Fourth in Our Shipyards

The Call for Ships Answered by Launching 450,000 Tons in a Single Day

IF there are any people in the enemy countries who believe that the U-boat is going to starve our Allies and prevent American troops crossing the Atlantic, we commend to their attention the fact that, in a single day, there were launched from our American shipyards 92 ships, having a total deadweight tonnage of 450,000. This is the answer of American labor to the organized brutality upon the high seas of von Tirpitz and the German Admiralty; and be it remembered that we are only now beginning to get into our shipbuilding stride. Some of our yards are not yet completed and a big program of additional yards is even now being started. Not only does this July Fourth celebration demonstrate that ships are coming along fast today, it is a pledge that ships will continue to be launched at a cumulative rate. With each successive month the total tonnage will show an increase.

Nor must it be supposed that, among these ninety-two ships launched July Fourth were many vessels which had been purposely held back in order that they might swell the total tonnage on that occasion. On the contrary, the Chairman of the Shipping Board, Mr. Hurley, in calling for a large output, warned the shipyards against any such practice. Therefore, we may take it that the huge aggregate is an expression of what our shipbuilders and labor can do in the way of speeding up work. It simply means that a large number of ships were launched on July Fourth which, but for the enthusiasm and hard work of the men in the yards, would not have taken the water for some weeks to come.

The magnitude of this effort will be appreciated when we bear in mind that the launchings represent about one-third more than was the production of seaborne tonnage in the fiscal year 1915 to 1916, and that it exceeds by over 52,000 tons of launchings for the year 1901, which was the record year in American shipbuilding before the present war.

The 92 ships launched consisted of 55 wooden ships of 195,200 tons and 37 steel ships of 254,800 tons. Among the steel hulls were the 12,000-ton cargo carrier "William Penn" and the 12,000-ton cargo carrier "Challenger"; three ships of 11,800 tons; three refrigerator ships each of 9,400 tons, and eight 8,800-ton freighters.

The 55 wooden hulls are of the 3,500-ton type, with the exception of one 4,700-ton ship and two of 4,000 tons.

To the Pacific Coast yards goes the honor of launching the largest total deadweight; for they put afloat 26 wooden and 17 steel vessels totalling 250,700 deadweight tons. Next comes the Eastern Seaboard with 27 wooden ships and 11 steel ships, representing a total of 172,186 deadweight tons. On the Great Lakes they launched 14 steel ships, totalling 47,700 tons. The distinction of launching the biggest individual tonnage of any yard in the country goes to the Bethlehem Union Plant at San Francisco, which sent three steel ships down the ways of a total tonnage of 35,400. Aberdeen, Wash., which launched four vessels, has the place of honor among the builders of wooden ships. Tacoma, Wash., and Portland, Ore., sent three hulls into the water and a like number were launched at Portsmouth, N. H. Mobile, Ala., Moss Point, Miss., and Orange, Texas, led the Southern yards, each launching two ships.

We have already recorded in these columns the remarkable feat of the New York Shipbuilding Yards at Camden, N. J., in building a steel ship of 5,000 tons in 37 days. Comparable with this as showing what enthusiastic labor and good organization can do, is the feat of the Skinner & Eddy Co. of Seattle, Wash., in completing an 8,800-ton cargo ship in 78 days; which brings to this company the distinction of having turned out six of the ten most quickly built vessels on the shipbuilding program.

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A New Chemical Show

THE Fourth National Exposition of Chemical Industries, to be held in New York during the week of September 23d, has just issued a statement of its preliminary plans. The exposition is a war-time necessity, and each exhibitor, regarding it as such, is planning his exhibit with a view to making it of the greatest benefit to the country. Those who visit the exposition, all of whom are bent upon the serious purpose of producing war materials in large quantities, will benefit greatly by what they will see and hear.

The amount of floor space already engaged is greater than last year; the exhibits will be much more attractive; and a movement is under way to show all exhibits of machinery in operation under actual working conditions as they would be found in the field. The South is again sending exhibits, and Canada is likewise taking the opportunity to present the materials it has available for development by the chemist and the financier. Technical and business men throughout the country should give heed to these exhibits, showing as they do how war-time needs may be met by coöperation between the chemist and the financier.

The program for the exposition will be a series of symposiums on the development of chemical industries in the United States, notably since July, 1914. This will embrace the period since the beginning of the European war, which, by removing the source of supply for many necessary materials in our domestic industries, inspired that development of our own chemical industries that is proving so timely now when we ourselves have entered the conflict. The program of motion pictures carries forward the idea of the symposiums, and so far as can be done with propriety, pictures will be shown of all the industries which have recorded notable developments. The exhibition will surely reward anyone who attends, be he chemist or layman, and will promote that "get together" stimulus so vital to America today.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Zone Postal Rate Again

IN the SCIENTIFIC AMERICAN of June 15th comment was offered in regard to the introduction of the Zone System of Postal Rates, which will have been put into effect on July 1st of this year. The reason for this legislation is the claim put forth by the Post Office Department that at the present time the transporting of periodicals in the United States exceeds the actual cost to the Department of such service by many millions of dollars. Certain figures are offered by the Post Office Department in substantiation of this claim; but it is a notorious fact that the method of bookkeeping used in the Department is of such a character that it is impossible to determine with any accuracy the cost to the Department of the various branches of the service. Nor is the educational value of many of the publications appearing in this country given any consideration, so far as the bill in question is concerned.

We are living at present in an age when efficiency alone will answer the requirements of the times. Yet the postal zone system could be picked out by the enemies of this country as a startling evidence of the complete break-down of our democracy and democratic methods; for if these enemies had themselves devised the bill, it could not have been more ingeniously or more subtly done, or with a more determined effort to put an unprofitable and unnecessary burden upon a particular class of business. The whole plan of the bill, as pointed out in the article above referred to, is unbusiness-like, unscientific and thoroughly inefficient. As also pointed out in that article, this is a time when every effort should be made to save labor in every walk of life, whereas the bill in question increases enormously the labor problem not only of the Post Office Department but of the individual publisher.

The question naturally arises, with what purpose did the members of Congress pass this bill, with all its defects and with the many objections that have been offered to it? It is often maintained by the press of the country that possibly Congress has been ignorant of this or that problem and has passed certain bills through such ignorance. This is not always the case, however, as the motives which enter into propositions of this kind are, not seldom, motives purely political. The members of Congress, as a whole, are generally men of education, men of considerable standing in their own community; and in the main they are patriotic in striving after the best interests of the country. There are exceptions to this as there are in every class in society. Some are elected because of political reasons alone and without any proper qualifications as legislators; some are fanatics teeming with the problems of the political forum; some are men who are not able to think straight on any subject and they are numbered among the fair representatives of a large class in every community.

In the past years there has been a practice in Congress, which we believe has fortunately now passed, namely, that of "passing the buck" to the President. We could, if we wished, mention laws which belong in this class of legislation. These have been framed for the most part under the guise of patriotism. Their true character has been of another kind; they have generally been the political policy of a political party for political gain, and they should at the time have been branded as such, and recognized as such, and vetoed as such by the President in power. Unfortunately this was not done. Many such bills have become the laws of the land, in some instances to constitute a heavy burden upon the people.

The Zone System of Postal Rates has been thoroughly exposed during the past few months, and on July 1st it will have become a law. The people of this country at the present time and, we believe, the members of Congress at the present time, wish only to see enacted such laws as are just and equitable, not only to the people at large but to all classes no matter what their business may be. No such claim as this can be put forward to support the law in question, and it is no credit to our nation to have such a law placed upon our statute books.

The only thing that can now be done in case you object to the burden which will be placed upon you and the country at large is to write to your Representative and your Senator and express your views freely and frankly. The chances are that they will not be out of sympathy with what you have to say.

Transatlantic Airplane Flight

AGAIN the project of crossing the Atlantic in an airplane is being discussed in earnest and is receiving the fullest approval of Allied and American officials. Indeed, so certain are the authorities that such a flight can be made, that the suggestion of forwarding our large military planes via the air route to Europe has been made by no less an authority than Major-General William Brancker of the British Royal Air Force, who is also Controller-General of British air equipment and a member of the British Air Council.

It was back in 1914, just prior to the outbreak of the war in Europe, that a serious attempt to cross the Atlantic in an airplane was being prepared for here in the United States. Up in Hammondsport, N. Y., there was constructed what was then considered a huge flying machine—the "America," a twin-engined flying boat designed by Glenn H. Curtiss especially for the transatlantic passage. Lieutenant Porte, of the British Royal Navy, was to navigate the craft. Trials had been made and the "America" was modified and tuned for the big undertaking. Everything was at last ready. Then the war broke loose on the peaceful world, and with the return of Lieutenant Porte to England the project was abandoned.

Perhaps it was just as well that the "America" did not undertake the flight, for the odds against success were very great. While a splendid craft, to be sure, the "America" did not begin to compare with the highly developed planes of today, which, as a result of the military experience gained in nearly four years of war, are more than a decade in advance of the old "America." But if there existed much doubt concerning the feasibility of the transatlantic flight then, there is but little at present. Flights from Turin to London, from London to Constantinople; raids carried far into enemy country with heavy cargoes of bombs, in all kinds of weather; daily flights under the most adverse conditions—all these factors have given us due confidence in the airplane of today even for so great a feat as the crossing of the big ocean.

Had the "America" attempted the flight and failed, others might have been discouraged from trying except with far more improved vehicles. As it is, the transatlantic flight, although attempted by Wellman in a dirigible, has never been actually attempted in a heavier-than-air craft. The field is absolutely virgin. Yet the chances are most brilliant that the first flight now undertaken, barring the greatest sort of misfortune, will be a success, encouraging other pilots to undertake the flight until the feat becomes as commonplace as the daily crossing of the English Channel by tens and even by hundreds of airplanes. Nine years ago the crossing of the Channel was a great feat; even four years ago it was a considerable undertaking, only to be attempted by the best of pilots. Today, practically all the British airplanes fly from their factories to the fighting front, in the hands of young pilots many of whom have just graduated from the flying schools, so as to save cargo space and valuable time. Which all goes to prove that once the Atlantic is safely crossed, others will not hesitate to follow; and before this war is ended we may yet see large American machines delivered through the air to the battlefields of France.

There are many excellent types of machines available for the transatlantic flight, provided the route is so arranged as to provide several resting places. Perhaps the best route is that from New York to Newfoundland, a distance of 1,363 miles; then to the Azores, a distance of 1,165 miles; after which there is a choice of routes, such as 1,300 miles to Queenstown, about a like distance to either Plymouth or Bordeaux, or 1,165 miles to Lisbon. By splitting the voyage into three relatively short laps the feat comes well within the possibilities of the huge Caproni airplanes of Italy and the powerful Handley-Page bombing planes of Great Britain, which are flying every day into the heart of enemy territory.

According to General Brancker, the enterprise could be carried out with motors of 740 horse-power, capable of 40 hours' flight. The motors should be capable of developing a speed of 85 miles an hour, and, when favored by winds, the seaplane employed should have an added speed of ten to fifteen miles an hour. There are three main problems involved, however: First, there is the question of engine reliability. Judging by the daily performances of such well-known engines as the Rolls-Royce and Fiat, the attempt could be made this year; surely, the Liberty engine will be ready for such a flight next year. Second, the navigating of the craft calls for great skill. Yet General Brancker does not hesitate to say that there should be no difficulty in providing pilots capable of seeing the craft over, if it is only a question of navigation. Third, and most important of all, is the matter of weather forecasting; for upon the accuracy of the weather forecast depends the chances of success. Given good weather all the way over, the flight should be more or less uneventful. But if the pilots encounter bad weather, the chances against success increase by leaps and bounds.

If the transatlantic flight is attempted in September, as is now being discussed, there seems no reasonable ground for doubting the possibility of the feat. The airplane is no longer that fragile, uncertain, baulky, unreliable and slow craft that it was in 1914. The great war has brought the transatlantic flight well within the realm of immediate realization.

Armament of Destroyers and Super-Submarines

THE question raised by our naval correspondent, Percival A. Hislam, on another page, as to whether the deadly depth bomb has not rendered it advisable for a heavily-armed submarine to fight it out on the surface, rather than run the risk of destruction below the surface by the bomb, is, at least, worthy of consideration. For it can scarcely be denied that the armament of two, 5.9-inch and two, 3.4-inch guns of the latest German submarines is more powerful than the armament of four, 4-inch guns carried by our destroyers. The weight of the broadside of the submarine is about 250 pounds as against a broadside of about 150 pounds for the destroyer. If the respective batteries were mounted on two destroyers of equal size, speed and maneuvering ability, there would be no question of the outcome of the duel; but it must be remembered that the gunners on a destroyer have an enormous tactical advantage over those on a submarine, be she ever so big.

In the first place, during the approach, the superior range of the submarine's 6-inch gun would be considerably offset by the high speed (30 to 35 knots) of the destroyer, for, owing to the fact that she is so quick on the helm, she would close in fast on a zig-zag course, which would make it extremely difficult to hit her until her own guns were within effective range. Furthermore, and this is an even more important consideration, practically all of the hits on the destroyer would be above water hits, whereas every hit on the submarine would be, potentially, an under water hit—for sooner or later, even if she were victor in the fight, the submarine must return to the submerged condition. But a single penetration by a 4-inch high explosive shell of the hull itself of the submarine would render submergence impossible. Although it is true that with increase in size there comes increase of ability to withstand rupture, leakage, or an inflow of water—and it is conceivable that the pumps aboard a super-submarine would be able to take care of a considerable amount of water due to damage,—it must be remembered that the amount of water that enters a submarine through a given aperture increases with the depth of submergence and would be very large even through a comparatively small aperture if the boat, in its escape, had to descend to the greater depths.

Mr. Hislam has done well, however, to draw attention to the growing gunpower of Germany's latest U-boats. We have long been of the opinion that this increase would take place, and many months ago we urged, and we now urge again, that our destroyers and all of our anti-submarine craft be armed with the biggest guns that they can carry. We would like to see the 6-inch gun on our first-class destroyers, even if it necessitated considerable increase in displacement.

Alcohol as an Automobile Fuel

ALTHOUGH this country produces about two-thirds of the petroleum of the world and turned out more gasoline this year than ever before, investigations are being carried on with a view to exploiting the use of mixtures of alcohol and gasoline in motor vehicles. It is now definitely established that alcohol can be blended with gasoline to produce a suitable fuel that will avoid the difficulties of starting a cold motor on alcohol alone, and without any change in the carburetor or the compression of the engine. The production of industrial alcohol on a large scale would accordingly help materially to increase the supply of motor fuel.

Nearly all the automobiles in Norway and Sweden are operated on alcohol made from waste sulphite liquor from pulp mills. Alcohol is also used in automobiles in Spain, where the sale of gasoline for use in passenger cars has been prohibited. Alcohol can be produced at the pulp mills in this country at a cost of 15 to 20 cents a gallon at the present time, and if all the paper mills suitable for the purpose were equipped with the necessary plants they would have a combined capacity of 15,000,000 gallons a year.

Waste from sugar mills and waste vegetable products provide other sources for the production of alcohol. Distilleries and breweries whose business is being curtailed by passage of dry laws in different states and by regulations of the Food Administration against use of grain for manufacture of intoxicants, have the apparatus and skilled labor requisite for the production of industrial alcohol from these wastes. They should welcome an opportunity to continue operation, utilizing such products.

Naval and Military

Lewis Gun in First Place.—According to a despatch from London, the Under Secretary of the War Office stated, recently, in the House of Commons, that the Committee appointed, as the result of the agitation caused by the use of a new type of Madsen gun in the British Army, to test the merits of different machine guns, had placed the various guns examined in the following order of merit: First, Lewis; second, Light Hotchkiss; third, Madsen. He stated also that the decision of the War Office Committee had been unanimous.

Concrete Ships for the Shipping Board.—Five new yards for the building of concrete ships, and the construction of a total of 42 new concrete ships have been authorized by the United States Shipping Board. Of these ships, contracts for 18 have already been given by the Emergency Fleet Corporation and contracts for the remainder will be let shortly. The ships will nearly all be tankers of 7,500 tons, with a capacity of 50,000 barrels of oil. Each of the 7,500-ton ships will have 2,800 horse-power and a speed of 10½ knots an hour. Others of the concrete ships are cargo ships, of 3,000 and 3,500 tons.

Copper Scarcity in Germany.—It is significant that the German Department which has to look after the metal supply has issued a bulletin stating that the stores, etc., captured in the Somme offensive last spring did not yield as much metal as was expected. Says the bulletin: "The demand for metals, especially copper, continues to be so great, that it has been necessary to issue new confiscation orders . . . the metal which is to be confiscated does not go merely to the army, but it has to satisfy the whole needs of the war; the navy, the railways, the post and our war industry in the widest sense have to be provided for."

Characteristics of Latest U-Boats.—The report of the British War Cabinet for 1917 stated that the German submarine has a surface speed up to 18 knots and a submerged speed of 10 to 11 knots. It carries from 15 to 20 torpoedes and can travel completely submerged for 100 miles, and can remain under water resting on the bottom for periods up to 48 hours. Although torpedoes used on surface ships have ranges up to five miles and speeds up to 40 knots, the range and speed of submarine torpedoes are much less, the latest boats preferring to wait until they are within 500 or 1,000 yards of the ship attacked, the speed of the torpedoes being sacrificed to an unusually heavy charge of high explosive in the war head.

Cost of Steel, Wooden, and Concrete Ships.—The estimated cost of building a wooden ship is about $165 a ton complete, and that of building a steel ship about $180 to $220 a ton complete. The estimated cost of concrete ships is between $100 and $110 a ton complete. The difference is brought about by the saving in equipment, time, labor and material. Compared to steel materials, the saving by the use of concrete often exceeds 50 to 55 per cent. In concrete there is also no waste of material; whereas it is reckoned that the weight of steel ordered for building a steel ship is perhaps 10 per cent greater than that of the steel which is actually used in construction. This loss in steel comes from waste in cuts of plates, angles, rivet holes and in other adjustments.

Our Navy Abroad.—The Secretary of the Navy has recently made public some facts regarding our naval war work, which are highly satisfactory. He tells us that we have now every type of vessel, from battleships down to tugs, lighters and barges serving in European waters; and in addition to Vice Admiral Sims, we have four Rear Admirals: H. B. Wilson, A. T. Niblack, H. Rodman, and H. O. Dunn, in charge of special branches of operations. Torpedo stations and aviation bases have been established, and navy aviators are coöperating with those of our Allies. Outside of a considerable number of submarine chasers we have over 150 naval vessels in European waters in charge of over 35,000 officers and men. In six months, one detachment of destroyers steamed in war areas over 1,000,000 miles; attacked 81 submarines; and escorted 717 single vessels and 86 convoys.

Shipbuilders Give a Day's Labor.—Official thanks have been sent the employees of the Sanderson & Porter Shipyard of Raymond, Washington. These men set an example of patriotic service by giving to the Government on May 30th a full day's work free of charge. Two shifts of 1,100 men joined voluntarily and unanimously in contributing the holiday and their services in order, as the firm notified the Shipping Board, "to advance the delivery of hulls." Chairman Hurley of the Shipping Board has forwarded this message of appreciation to the workmen: "Nothing could be more in keeping with the spirit now actuating all loyal Americans than this evidence of patriotic interest and sacrifice. May I express my own appreciation and that of the Shipping Board of your generous action and tell you how proud we are to have you men associated with our shipbuilding program."

Science

Experiments with Hog Cholera Bacillus.—C. Tenbroeck, writing in the *Journal of Experimental Medicine*, reports that he has increased the virulence of a culture of the hog-cholera bacillus 1,000 times by passage through a series of 11 rabbits. The organism used in the experiments was isolated several years ago from the spleen of a pig which had died of the disease. After isolation it was passed through a rabbit and has since been kept on slant agar in the cold, transfers having been made monthly.

Radium Investigations.—A problem that has recently arisen in the treatment of carnotite ore, the chief source of radium, is the efficient handling of the carnotite concentrates for the extraction of radium. The U. S. Bureau of Mines has developed an improved method of treating the concentrates, though the process is neither so cheap nor so easy as the treatment of the ore itself. The Bureau has also developed a method for the treatment of radium-barium sulfates high in silica so that the silica can be efficiently and cheaply removed. Considerable work has been done by the Bureau on pitchblend as regards concentrating low-grade ore and treating both the ore and the concentrates for the recovery of radium and uranium. These and other investigations relating to radium and other radioactive metals are in progress at Golden, Colo., under the direction of R. B. Moore.

Persistent Volcanic Vents.—Dr. H. S. Washington, who has made an examination of the early literature of Stromboli, states that of the six vents of that volcano which were active in August, 1914, on the crater terrace, at least three have persisted in location as far back as 1768. He notes that at Kilauea the main vent has persisted in location for about a century, and evidence of similar persistence is found in other volcanoes. It is also noteworthy that the oldest three vents at Stromboli open about 1,000 meters above sea-level near the upper edge of a precipitious scarp, and vents of analogous location are found on Etna and Kilauea. Such vents, it is stated, cannot have originated through explosive agencies; their formation, situation, persistence in location and other features are best explained by Daly's so-called "gas-fluxing hypothesis," which supposes that narrow vertical vents were "blow-piped" through the overlying strata by hot gases derived from the magma in its reservoir below.

Health Conditions in Alaska.—In the year 1912 the U. S. Public Health Service sent Dr. E. Krulish to Alaska to study the diseases and sanitary conditions in the native settlements. His studies, which extended over a period of three years, showed that the native population was decreasing at an alarming rate, chiefly from tuberculosis. Homes, with but few exceptions, were found to be insanitary and responsible in great measure for the prevalence of disease and the high death rate. As a result of this survey Congress was urged to authorize the establishment of a chain of small hospitals along the coast and on the Yukon River, in order to reach as large a portion of the scattered population as practicable. Congress appropriated $25,000 for medical relief in Alaska in 1915, $50,000 in 1916, and $62,500 in 1917, and although these amounts are inadequate, much has been accomplished. Last year five hospitals were in operation, with nine physicains and 10 nurses. Two of these institutions are modern and satisfactory, but the others have merely been improvised in school buildings.

Experiment Stations of the Bureau of Mines.—In March, 1915, Congress authorized the Bureau of Mines to establish, eventually, ten mining experiment stations. The last annual report of the Bureau describes the three which have already been established at Tucson, Ariz., Seattle, Wash., and Fairbanks, Alaska. Prof. C. E. Van Barneveld, in charge of the Tucson station, has been making a general survey of the mineral resources and metallurgical problems of the mining camps in Arizona, southwestern New Mexico and southeastern California. The station is located at the University of Arizona, and is provided with chemical, electrical and ore-dressing laboratories, an assay-furnace room, and a general metallurgical laboratory. The Seattle station, under T. Varley, is housed at the University of Washington. Here it is planned to establish a coal-washing laboratory, especially suited to studying methods of reducing coals of the Pacific northwest and of Alaska and methods of burning the washed coal. Electrometallurgy will also receive special attention at Seattle, as the region contains abundant waterpower for hydroelectric plants. Other problems to be studied at this station include the recovery of gold, platinum and rare metals (such as palladium) from the black sands of the Pacific coast and the possibility of utilizing the black sands as a source of iron. The Fairbanks station was in course of equipment during 1917. Among the important investigations to be conducted are the development of more efficient methods of working frozen placer ground and the application of hydroelectric power in the mineral industries of Alaska.

Electricity

The Pitting of Bearings by Leakage Current.—Owing to the presence of grounds and also because of weak insulation of some of the armature coils electrical leakage occurred on some of the motor-generators used in a generating plant serving a railway system. The leakage current transversed a path along the shaft and through the bearings, causing pitting or disintegration of the journal surfaces. As a remedy there was assembled and affixed to the end bearing a ¾-inch by 1¼-inch copper brush which afforded a low-resistance connection between the shaft and ground, according to *Electrical World*. It was made adjustable so as to provide for wear. After three years of use no pitting has developed.

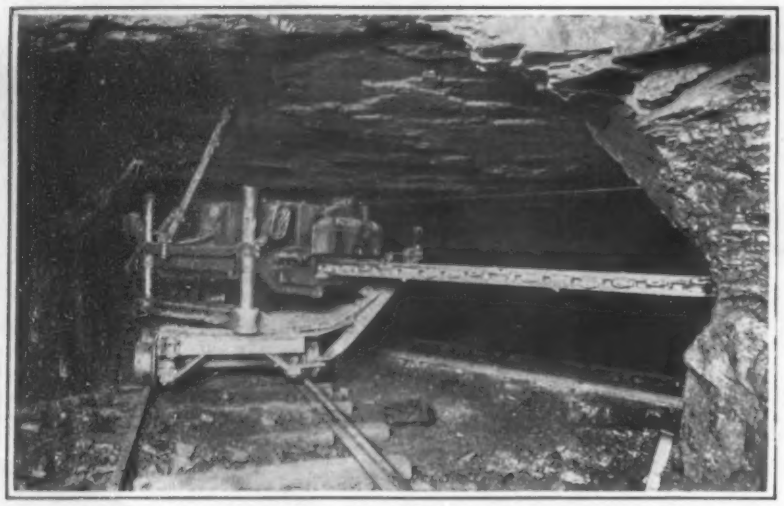
Measurements of Rapidly Varying Temperatures.—According to *Elektrotechnic und Maschinebau*, special apparatus has recently been contrived to measure rapidly fluctuating temperatures such as an ordinary thermometer is too sluggish to record. At the point of measurement wires of platino-iridium, 0.02 mm. diameter, are inserted and are connected to a galvanometer. The deflection varies with the resistance of the wires, and it is stated that variations in temperature with a frequency of ten per second may be noted. It is anticipated that the apparatus will be specially useful for studying cyclical variations in temperature in the cylinders of steam engines and combustion engines.

New Form of Primary Battery.—A recent French patent describes a new method of treating the positive electrodes of primary batteries with a view to introducing metallic oxides as depolarizers. The electrode consists of a shallow plate of copper or iron representing numerous conical points to the alkaline element in the cell. The edges of the plate are bent over so it becomes a form of shallow box, into which the depolarizing oxide is introduced. This material is mixed in a powdered state with a suitable alkaline hydrate or alkaline earth and introduced into the interior of the box formed by the positive and a zinc plate as negative. The whole is sealed with rubber, a small vent being inserted to allow for the escape of gases, and cased in metal stiffening bands.

An Improved Hand Magnet.—With the magnetic coils, switch and connections entirely covered by two aluminum castings, a newly introduced hand magnet presents a vast improvement over the usual device of this nature. The circuit to the magnetic coils is closed and opened by means of a large trigger, mounted under the handle support, which operates a strong make-and-break switch concealed in the aluminum cover. The trigger is operated by the index finger; pulling it toward the handle closes the switch. When slightly released the switch does not open, but when fully released the switch opens with a quick break. The magnet can be used for a wide variety of purposes, such as in the recovery of nails from shipping room sweepings, handling hot castings, removing iron and steel filings from machines, and removing filings from liquids.

Ball Bearings for Electric Motors.—Some time ago there appeared a most interesting discussion of the application of ball bearings to electric motors in our contemporary, *Electrical Review*. Apart from diminished friction and reduced costs of lubrication and maintenance, it was claimed that such bearings facilitate short air-gaps and good permanent alinement. It was also stated that the overall length of the bearings can be reduced by 10 to 27 per cent. Ball bearings are considered specially suitable in cases where there is much vibration and shock, but require to be refilled with lubricants at intervals varying from one week to six months. As a special instance of their utility the author mentions some experience with axle-driven lighting generators on railway coaches. The cost of maintenance was reduced 46 per cent on dining cars and 66 per cent on ordinary coaches by the substitution of ball bearings for ordinary ones, and many common faults arising from hot bearings were practically eliminated.

Insulator Depreciation.—Numerous experiments have proved that porcelain rapidly becomes an electrolyte with an increase in temperature, according to C. E. Oakes in the *Journal of Electricity*. When it is also considered that porcelain which has absorbed more or less water is already an electrolyte, failures are to be expected. There are reasons for believing that a large percentage of the total failures are due to cracking of the porcelain in the insulators. The many factors which contribute to the mechanical stresses to which an insulator is subjected complicate the problem of ascribing causes to a given failure. Among the factors which cause undue stresses can be named: (1) Faulty design of the insulator; (2) use of material having widely different temperature coefficient—that of porcelain is about one-half that of steel; (3) the stresses set up in the insulator due to the change in volume of cement under varying weather conditions, and (4) the gradual increase, with time, in volume of the cement. Investigations to determine the change of volume with temperature variations, breaking strength of porcelain, etc., are outlined and useful information presented in the article.



Cutting out a streak of slate before blasting (ordinarily impossible)

Storage battery locomotive moving a loaded car from the heading

The Government and the Distribution of Coal

The Wisest Kind of Regulation, and What It Would Do to Relieve the Situation

DOUBTLESS there are flaws enough in the present system of mining coal. But the finest production system in the world is helpless in the face of distributing machinery that is not up to the mark; and this is a feeble characterization indeed of the way in which our coal is shipped. Present methods of distribution are at grave fault in more ways than one. For one thing, every operator, under the keen lash of competition, has been driven to sell his coal when and where he can; and a state of affairs has been gradually brought into being under which the output of a single mine is distributed over an abnormally large geographic area. The operator sells a few cars here, a few cars there; the big consumer or the jobber buys his coal in the same way. Few dealers or consumers get their entire supply from a single mine, few mines distribute their output to a minimum number of consumers.

Under this system the mine finds that it is shipping coal in all directions to a large number of customers scattered here and there throughout a large number of states. If it were possible to get the user of coal to buy his entire requirements from one mine this situation would not exist. But the condition has come into being gradually; and naturally, a mine operator is chary of giving up good customers at a distance in the hope of being able to replace them nearer home. The consumer is equally chary of severing relations with a producer at a distance in the hope of being able to fill his wants nearer home. The whole business represents an evil which cannot be corrected by private initiative; but by Federal control of the output it can be corrected.

The great uneconomy of the present system may be made clear by means of an illustration or two, using a certain mine in the Harlan County field of Kentucky. The normal output is perhaps 25 railroad cars of coal per day. The mine may have on hand unfilled orders from 50 or 100 customers. Each and every one of them is probably writing and wiring to have part of his shipment put under way. The operator, knowing their needs and wishing to satisfy them as much as possible, may ship one car to each of 25 of them—he would ship a car to each and every one if he had the coal. What happens? These 25 customers will be scattered through Iowa, Minnesota, Indiana, Ohio, Kentucky, Tennessee, Georgia, Florida, Mississippi, with perhaps a few in other states.

It is within the realms of reason to suppose that as many as 25 different railroads will have to handle these cars. Now this mine is not the only one in Harlan County; there are 50 others, and it is possible, assuming the worst state of affairs, to have all the cars from all these mines going to different customers in different places.

Let us look into the effect of this sort of thing upon the railroads. At night, after the cars are loaded, the railroad's mine crew, as it is called, gathers them from the sidings at the mines and makes up a train. This train is hauled to a small yard at Varilla, Ky., about thirty miles away. Here, after weighing, the cars are separated into three groups, one going north, one west, one south. As soon as a train is made up for any one of these directions it is moved to Corbin, Ky. Here, for example, a northbound train is again sorted to separate those cars whose destination is along the railroad under consideration from those which have to go to the end of the line.

At Covington, opposite Cincinnati, another sorting takes place. Here the cars coming in from all gathering points are sorted out once more into different trains for delivery to the different outgoing railroads. When they are delivered to these roads they are again sorted for convenience in handling. It may be that the railroad to which they are delivered here is but an intermediary to turn them over to still another line, which means more sorting. And this condition is not peculiar to the Harlan field, but is fairly representative of the course of coal traffic for mines and railroads throughout the country.

What is the result of this continued sorting of the coal in the railroad yards? In the first place, every time a coal car arrives in a distributing yard, 24 to 72 hours pass before that car leaves that yard. This loss of time is due to switching of the cars to make up trains for other points. The layman will have to exercise his imagination to the limit to realize what it means to take ten fairly long trains and shuffle the cars in them up into ten new trains. It is not like sorting out slips of paper, where one lays each slip in turn on its proper pile. You can't pick a car out from the middle of a train and swing it through the air to the place where you want it. You have to shunt it back and forth, with all the rest of the train behind it or in front of it; and perhaps you have to shunt the train to which it is going in order to get it in the proper place in that train. In the simple case of a coal shipment from Kentucky to Minnesota there will be at least seven days lost in shipping, possibly 21. As a result of this switching the average movement of a freight car is about twenty miles per day and a coal car averages only 9½ trips from mine to market and return per year. And we have seen why this condition cannot be remedied by the operators.

Another point that tends to delay in the handling of coal—at least, delay in comparison with what might be—is due to the shipping of coal into territory that should be served by other coal fields. In fact, coal is often shipped from one field through another. Take the same example, from Harlan County. Coal from this district is supplied to Iowa, a state in which there are large coal fields. It goes also to Minnesota, Wisconsin and the Dakotas—right through the middle of the coal fields of Indiana and Illinois. It goes to Missouri, which has a large number of mines of its own, and in doing so passes through the coal fields of Western Kentucky, Indiana and Illinois again. It goes to Michigan, which, while producing coal, consumes more than it mines, and so must buy; but in going there it passes the coal mines of Ohio and Indiana. Finally, it goes to Ohio, Indiana and Illinois themselves, which produce more coal than Kentucky ever dreamed of.

The proper territory for the southeastern coal field of Kentucky is in the southern states. True, there is coal mined in Tennessee and Alabama. But the greater part of the Tennessee coal is from the same field as that of which we speak, which does not respect state boundaries; and neither Tennessee nor Alabama has much more than enough to supply its own needs.

In looking over the reports of the Interstate Commerce Commission it will be seen that anthracite coal from eastern Pennsylvania is shipped as far west as Chicago. It can be bought in any of the large mid-western cities. This coal will have been shipped through the central and western fields of Pennsylvania, and through the Ohio field, some of it through the Indiana and Illinois fields in addition.

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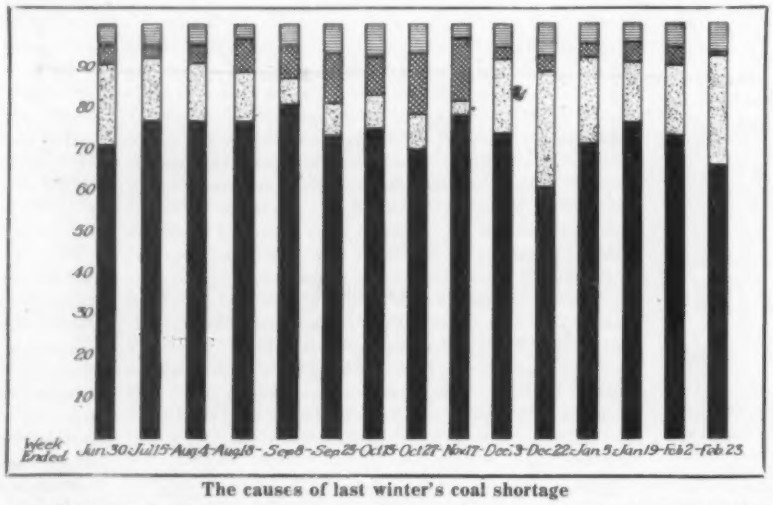
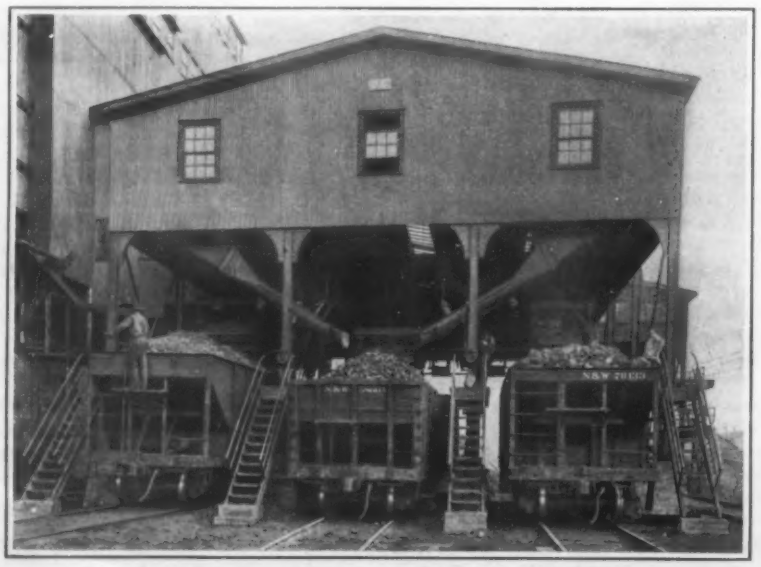


The causes of last winter's coal shortage

The full height of the columns represent the normal output, or one hundred per cent. The solid black shows the per cent actually mined. The other regions show the per cent of loss in production due to causes as follows: dotted, car shortage; crossed, labor troubles; lined, all other causes. It will be seen that car shortage was by far the most serious factor, even when ignoring the fact that it was at the root of much of the labor difficulty



An automatic sizer and loader. The slack is on a back track

How the Hispano-Suiza Engine Came to the Forefront of Aviation

NOW that our Aircraft Production Board has been delving into the question of motors, the four years of experience behind our allies has brought forth as no other condition could, the sterling qualities of the good engines as contrasted to the handicaps and shortcomings of the poor engines. And one of the engines which has been included in the "good" category is the Hispano-Suiza, which, during the past year or more, has been closely identified with the exploits of the leading British and French fliers.

Prior to August, 1914, the Hispano-Suiza engine was being built for motor cars of quality in Barcelona, Spain, where the main factory was then located, with an additional small plant in Paris. All the engineering work had been carried out by M. Marc Birkigt, a Swiss engineer, who, previous to developing the engine, had been for eight or ten years a mining engineer, and who had also been connected with one of the best machine-tool firms in Switzerland.

While Burkigt's engineering and development work had been done almost entirely in Switzerland, the first actual models were produced in Spain. It is of interest to note that Spanish capital is heavily invested in this engine, and that King Alfonso of Spain is one of the largest individual holders in the foreign company. Indeed, it was owing to this Spanish financial interest that the engine was originally named Hispano-Suiza, which actually means "Spanish-Swiss."

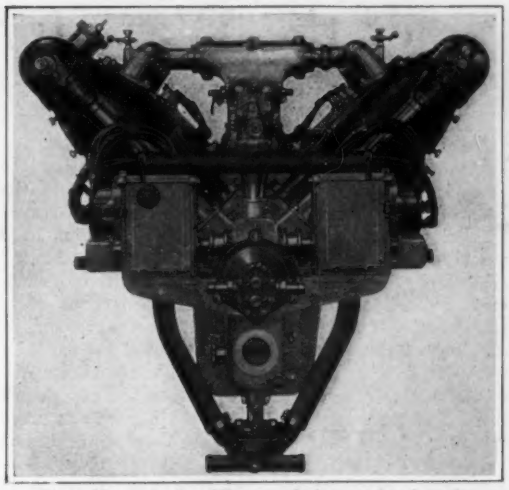
Birkigt's mind when later devising this aviation motor was evidently influenced subconsciously by his knowledge of the exigencies of machine tools, for his engine offers today the special advantage of requiring less labor and less raw material than any other of similar power.

It was only after the war was nine months old that the first Hispano-Suiza engine was completed in the Barcelona factory. Essentially, it was little more than the coupling together in V-form of two of Birkigt's fine four-cylinder automobile engines, the power obtained being about 150 horse-power at a speed of 1,800 revolutions per minute. At that time all of the notable French firms were hard at work trying to devise an aviation engine of the "fixed" or non-rotating type, for with but one or two exceptions the great majority of engines used on French planes were of the rotary type, such as the Gnome, LeRhone and Clerget. The highest power obtained in those days was but 90-horse-power, on the average.

From the very beginning the performance of the Hispano-Suiza left no doubt as to its adaptability to the French air service. Yet there existed in France, as has later been expressed in the United States, a very strong national prejudice against any device that was not thoroughly French in its conception and production. For more than four months it seemed impossible to have this motor given serious consideration by the French military aviation authorities, and it was only at the personal intervention of General (now Marshal) Joffre in September, 1915, that Major Martinot La Garde was ordered to proceed to Barcelona to make a comprehensive report on the motor. The result of Major La Garde's investigation finally brought about a further development and the subsequent production of the motor in France. In December, 1915, and January, 1916, 800 were ordered for the French air service, 450 of which were subcontracted to an American organization which was formed for the purpose in the United States.

Things were happening fast in the aeronautical line during the winter of 1915-16. German preparedness had given them complete supremacy in the air, and the situation became so acute that prejudice and vacillation were put behind political and industrial France. Immediately, French manufacturers began to give up their attempts at developing aviation engines of their own of the "fixed" type. There was only one firm building an engine of its own design, namely, the Samson Company. There were two other firms building "fixed" engines—the Renault and the Lorraine—but these were not from their own designs: at the suggestion of the French government these firms were manufacturing motors of the German Mercedes type. Gradually, however, during the year of 1915, all the leading French firms became subcontractors to the Hispano-Suiza Company, among them being Peogot, Delanauy-Belleville, Panhard, Brazier and de Dion-Bouton.

By that time the 150-horse-power Hispano-Suiza was developing 180 horse-power at 1,800 revolutions per minute. A desire for still further power on the part of the French government induced Birkigt to raise this engine to 2,200 revolutions per minute, thus developing 220 horse-power, with a reduction gear permitting the use of such power on the propeller at the efficient speed of 1,200 to 1,500 revolutions.



The eight-cylinder Hispano-Suiza engine largely employed on Allied battleplanes

It was clearly understood, however, that this 200-220-horse-power type was a makeshift to meet the heavily-engined German fighting planes, although it gave extraordinarily good results in the hands of a number of French pilots of the "ace" class. But on the whole it was a disappointment at the front, and caused certain difficulties which competitors did not fail to exaggerate. In all fairness to Birkigt, however, it must be emphasized that the makeshift was brought about on the insistent demand of the governmental authorities. By now the designer had created two new types: the first, the standard 150-horse-power; the second, the 300-horse-power. The power of the latter was obtained by increasing the length of the stroke and the diameter of the cylinder bore, as is the usual practice. The 200-horse-power engine was, for the reasons already explained, more a transitory type between the 150-horse-power and the 300-horse-power than anything else, and for the past year it has permitted French battleplanes to retain the air supremacy established. It is a matter of record that of the total German planes destroyed during that period by the French aerial forces, 90 per cent goes to the Hispano-Suiza engine while the remaining 10 per cent is distributed among the other engines in use. Only on May 19th last, Fonck, the premier French "Ace" since Guynemer met his end, brought down six German planes in one day and three on the second day following, using a Spad combat machine equipped with a 200-horse-power Hispano-Suiza engine. And that despite the fact that the engine has been considered a makeshift!

In the French air service the Hispano-Suiza engine is held in the very highest esteem. There are many among the "aces" at the front today who have the original 180-horse-power engines on their Spads, and who refuse to part with those engines. Indeed, the engines are often patched up at the front for fear that they might be taken away from them should the machines be sent back of the lines for regular repair. Many of these old

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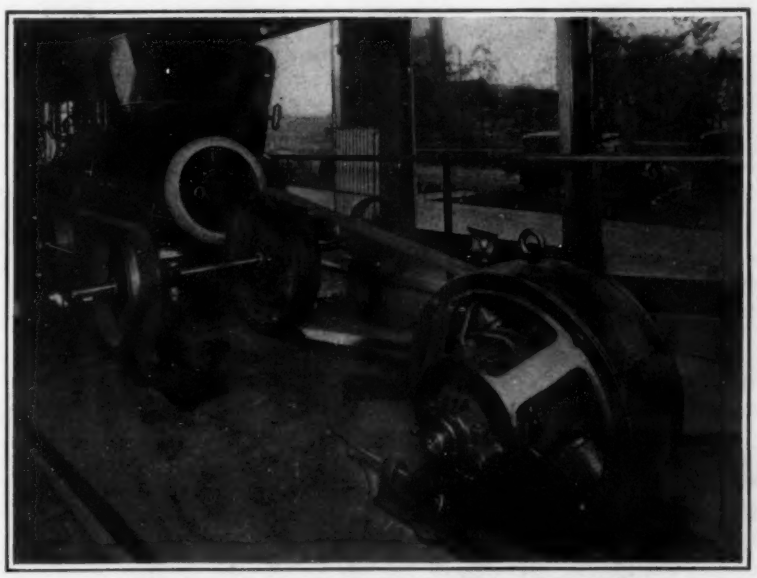

A forty-seven day non-stop endurance run in a show window

Twenty-Six Thousand Miles Without Moving

A 26,000-mile endurance run without leaving the display room is the feat recently performed by an automobile in Boston. In arranging for a test which would show the staying qualities of their car, the manufacturers wished to secure the maximum of publicity before the crowds which daily passed their showroom. So they brought a car out of stock, blocked the wheels clear of the ground and belted the rear wheels to a 17-kilowatt generator. The electrical load on the generator was fixed at such a value as to put a load on the automobile engine equivalent to that caused by the car's climbing a 10.5 per cent grade at about twenty-two miles per hour at high gear, part of the power generated being used to light the showroom inside and outside. During the test period the motor was under continuous observation by newspaper men, automobile experts and technical men from the various institutions in and around Boston. Most of the time the crowds in front of the window rendered it difficult to get near the glass.

During the run the car covered a distance equivalent to 26,149.3 miles and consumed 1,163 gallons of gasoline, an average of 22.49 miles per gallon. The oil consumption was 220 pints, being 950 miles per gallon. The distance exceeds the previous record for non-stop run by over 4,000 miles.

For automobile testing the electric generator furnishes an ideal load as it is easily installed, readily adapted to give any load within its capacity and once this adjustment is made it does not change. In fact, where direct current is supplied for general lighting and power purposes the generator may be connected so as to return to the lighting system nearly all the power generated by the automobile engine. In this manner the cost of the test may be cut down very considerably. These advantages are realized by the manufacturers of automobile engines, who use electric generators to a very large extent for testing their machines before shipment. A direct current machine is used first as a motor to start the gasoline engine and run it until the cylinders have become somewhat ground in. By merely moving a rheostat handle the load is then placed on the engine and it is run driving the electric machine as a generator during the remainder of the test.

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One of New York's sirens to warn the public against Hun air raids

Sirens to Warn New Yorkers of Air Raids

COME what may, the Germans are not going to find New York city utterly unprepared if they attempt an air raid by means of cargo-carrying submarines and seaplanes. Not only have the police authorities worked out a definite plan of action in the event of hostile attack, but warning sirens are now being installed in various parts of the city.

Some idea of the type of electric warning siren being used in New York city can be obtained from the accompanying illustration. This powerful generator of sound is operated by a two-horse-power electric motor, protected from the elements by a substantial casing placed between two huge horns as shown. The unmistakable shriek of this type of siren can be heard within a radius of two miles, so that a comparatively small number will be required to cover the metropolis.

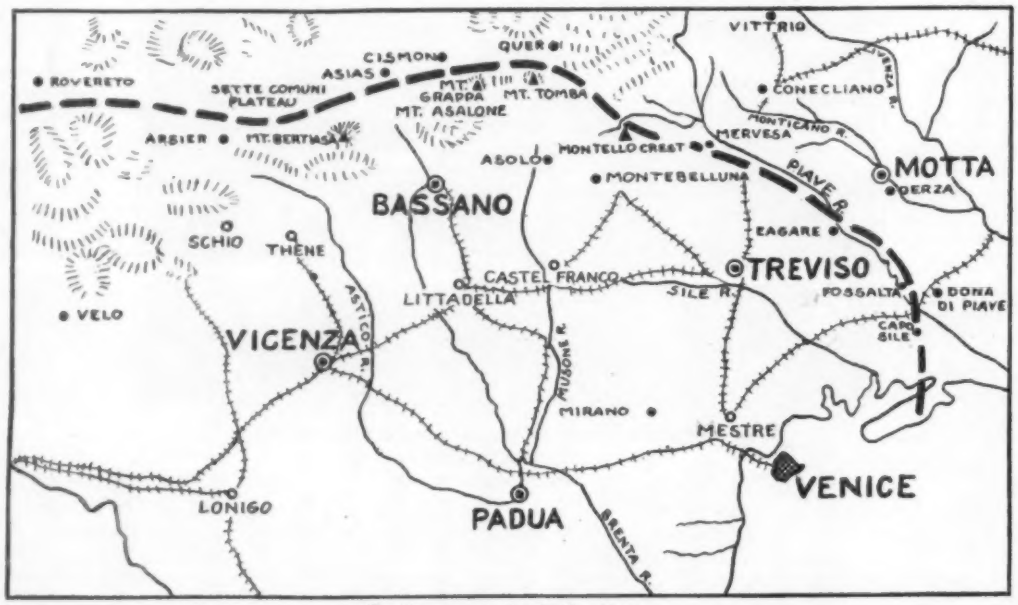
In addition to the system of sirens, New York city may also adopt the Paris method of warning the public of a Hun air raid, namely, that of sending fire-engines throughout the city, equipped with powerful sirens.

Strategic Moves of the War, June 25th, 1918

By Our Military Expert

THE fourth German drive that began on the Oise on the 9th of June is already a thing of the past and it can be considered as finished on this part of the line. Between Montdidier and Noyon the battle has been one of the bloodiest defeats that the Germans have suffered since the six months' struggle at Verdun. Having driven forward in the first three days to the Matz River south of Lassigny and in the area below Ressons (sur Matz), they were finally halted and their communications seriously threatened by the French who attacked south of Montdidier, retaking by assault the villages of Courcelles, Mery and Belloy and driving the Germans back to the line Rubescourt-Cuvilly-Marquéglise. The main German attack was again shifted to the east of the Oise River; *i. e.*, to the west side of the Aisne-Marne salient southwest of Soissons. This of itself was proof that the attack west of the Oise had failed and, in fact, that it had been by far the least effective of the four German drives to that date. It had overrun the first line of French defenses but it made no serious breaks in the main defensive positions further back. Where breaks did occur, French reserves were promptly on hand to counter attack and close them. These reserves were ample not only to do this but to push forward with success.

In the first three German drives of the present year, toward Amiens, Ypres and Chateau Thierry, the Entente Allies were seriously hampered by the lack of local reserves ready for support. As a consequence, there were no divisions that could be gathered up to organize immediate counter attacks. The lines had to bend back day after day until they were strong enough to hold fast. The Germans therefore apparently had proved their superiority; their new methods of strong assaults with ample reserves seemed more successful than was really the case. But here south of Lassigny the French were thoroughly prepared to stop the German onset; and this was done practically on the third day. They could no doubt force the Germans back out of Ressons if it were of any great advantage to do so. But Compiégne was the German objective and that town is now amply covered by the French troops; their ability to protect Paris has been shown to be not materially impaired despite German gain of territory. The latter has been won at a terrific cost in men and material, but in the lines now gained by them in their counter attacks the French are in possession of the strategic points. It can be said that they have the situation so well in hand they are prepared to meet, with the aid of their allies, the next German move, no matter at what time or place. In this last offensive the Germans have advanced not more than five miles in five days and have had demoralized through losses thirty or thirty-five divisions (three hundred and seventy-five or four hundred and twenty thousand men).



Battle area on the Italian front

It seems more and more evident that the exhaustion of Germany in man power has gone much farther than has generally been believed. This would appear to be indicated by the time, since March 21st, during which each drive has gone on. The one that began in March continued for 14 days and the one around Armentiéres that started on April 9th lasted 10 days. The two battles were closely related one to another and were followed by a number of violent and vigorous local fights. The battle of the Chemin des Dames and on the Aisne continued between eight and nine days and was followed by the drive on the Oise which began on the 9th and ended on the 13th of June. All this seems to show that the Germans are beginning to realize that they must economize their man power as far as possible. The repeated blows that the French resistance has compelled them to make at various parts of the line have caused great losses and must have most materially reduced the number of their reserves.

Despite their checks on other parts of the Aisne front, they made a strong assault on the 19th on Rheims, employing for this purpose three divisions or approximately forty thousand men. It was a strictly local attack and had for its object the capture of the city and the heights back of it. While the French hold their dominating points, the rear and left flank of the German lines between the Aisne and the Marne are seriously threatened by flattening out the salient at Rheims, now jutting into their front, and by forcing back the French to the Marne River, their position would be greatly improved for miles to the east and their advance upon Paris would be made much easier. The battle line extended all the way from Vrigny southwest of Rheims in a semicircle around the city to the fort of La Pompello some miles southeast of the city. The attack was preceded by an almost unprecedented bombardment of gas and high explosive shell, so that there was evidently no surprise in the move. The Germans were defeated with heavy losses and their attempt to take the city was an utter failure. Rheims has for a long time been hemmed in on three sides by the Germans; it has therefore always been considered only a question of time when a concerted onslaught would be made to drive out its defenders. The place is now only a heap of ruins, its far-famed cathedral included, and its possession by the Germans, as with Verdun, would be only a matter of sentiment. This battle is but one of the nibbling operations that must be expected; the Germans cannot long remain quiet. The nation is pressed for time and some success must be gained somewhere. But the Allies continue to balk every stroke and in France, as in Italy, confidence in their strength and ability to hold is growing each day, whether the enemy direct his main efforts toward the Channel ports or toward Paris. It is known that the German enthusiasm and ardor have disappeared and the German army begins to realize that the days of easy victories have passed, never to return.

What will be the next move is a great question and one most difficult to predict. The German advance down the Oise has been successfully blocked; no progress can be made here without an enormous waste of human life and men cannot now be well spared. But such an advance would offer many advantages for it would straighten out the line between the acute salient at Chateau Thierry and the bulge at Montdidier. But, as matters stand, it is more than probable the Germans will adopt once more their usual methods by shifting suddenly to some other point with the hope that the French commander will not foresee and that they may be able to carry forward their lines a few miles. While Chateau Thierry is their nearest point to Paris, it is already dangerously in advance of their main lines; it is also undoubtedly the point where the French commander would strike if he were not husbanding so carefully his reserves and restricting his moves for the present to the defensive. It is more than probable the next move will be to the west and any new advance that is attempted will be toward Amiens. Such a move promises more in case of success for it would threaten both Paris and the Channel ports. It would also menace the railroad connections of Paris with the sea; if successful, it would cut off the British army from its allies. No doubt all these facts are as evident to the Germans as to the Allies; if the former are contemplating such a move, the latter are making preparations to meet it. The Germans are compelled to be continuously on the offensive with the forlorn hope of gaining a decisive victory before American troops arrive in numbers sufficiently large to allow so strong an advance that the German army will be swept out of northern France and Belgium.

About the middle of the month the Austrians began a tremendous attack on the greater part of the front in Italy from the Asiago plateau on the north above the Lagarina valley and west of the Brenta River to the Adriatic on the south. The attack was preceded by a violent bombardment; after a terrific gun fire heavy infantry assaults were made against the Allied lines. From the Astico to the Brenta River, from the Brenta to the Piave and down the Piave from the mountains to the sea, the attacks were made in full force. The blows however, found the Allies prepared; for the British and French troops that were brought into the struggles last year have strengthened greatly the Italian lines against the offensive drive that was made by the Teutons. The front of attack included more than half of the Italian front. The Lagarina valley, down which the Adige flows, runs north and south to the east of Lake Garda. The battle lines cross this valley about five miles inside the Austrian frontier and about twenty-five miles north of the city of Verona. From this area the lines run southeast to the vicinity of Thiene and northeast to the Piave River near Segusine; they then follow the Piave to the sea. The Asiago plateau lies between the Lagarina valley and the Brenta River, directly north of Vicenza, which it defends. The lines of the middle Piave protect the city of Treviso 15 miles north of Venice. It has been understood by the Allied General Staff that if the Germans succeeded in Picardy in breaking through the Allied armies or in forcing the French back to the defenses of Paris, the Austrians would attack west of Lake Garda down the Giudicaria valley; this would bring them into the manufacturing and metallurgical center of Italy and would force an early decision by throwing Italy out of the war and by threatening an advance upon France through her southeastern back door.

If the Germans could gain no material success in their plans on the French front, then the Austrians were to continue the campaign of last fall and early winter by driving into the plains of Venetia from the north, throwing back the Italians from the Piave to the Adige and from the Adige to the Po, thus forcing them to retreat south of Lake Garda. In the first mentioned move, west of Lake Garda, the Germans and Austrians were to act jointly; in the second case, the Austrians would act alone as the German would need all their forces in France.

When the Teuton drive ended in December last, there were two dangerous openings in their favor as soon as they could be reinforced in the spring; one was on the Piave angle where the mountain lines joined those on the Piave River; the other was the valley of the Frenezella River where it joins the Brenta above Valstagna. At either of these points the Piave lines would have been taken in the rear. But on December 30th the French closed the first approach by gaining a victory; two weeks later the Italians gained a similar advantage at the Frenezella. The present offensive has therefore not been unexpected, knowing what has happened to the German drives in France.

The long expected Austrian attack commenced on Saturday, June 15th and the fighting quickly spread along a front of 130 miles, one-half of which is in a mountain country. There were apparently three attacking groups, one in the north having as its objective the Asiago plateau, with its southern limits, and the mastery of the Vicenza plains; the center group trying to force the Brenta passes and to attack the rear of the Piave lines; the third group, endeavoring to force the passage of the Piave in order to march on Mestre and Venice. But the Austrians had only 72 divisions (about nine hundred thousand men) with which to try to break through on such long lines. On the north the British, French, and Italian troops, after a short retirement, held their own and even gained back the ground lost. In the center an advantage was obtained by the Austrians by the capture, on the hill of Montello, of ground that took the assaulting forces up to the summit midway of the two sectors into which the 80-mile front here is divided. The value of this hill is that, if taken in its entirety, it would dominate from the flank and rear all the Italain positions that defend the lines of the Piave River in the flat plains to the south and would give

(Concluded on page 24)

The Safety Zone for the Submarine

Is It Better to Face the Gun than the Depth Bomb?

By Percival A. Hislam

THAT the existence of German and Austrian submarines is daily becoming more uncomfortable and hazardous is well recognized now by everyone except those enemy subjects who are still able to find cause for satisfaction in the much subdued boastings of Admiral von Capelle. Since the beginning of 1915 the countermeasures in operation against the U-boat have been multiplied not only in number but also in variety, and they now include—to mention but a few of them—surface chasers, destroyers and drifters, submarines, aircraft, cement-logged ships sunk in the mouths of their bases, and vast minefields of which one alone, stretched across the northern exit from the North Sea, covers an area of no less than 22,000 square miles.

The "chivvying" of the U-boat has been so greatly accelerated of late, and has proved so remarkably successful against U-boats in the awash or submerged condition, that it is rapidly becoming a problem for the Germans whether, after all, the surface is not the safest place for their undersea boats. Before examining this somewhat paradoxical proposition, let us glance briefly at the history of the U-boats tactics. After the sinking of the "Aboukir," "Hogue" and "Cressy" had put Allied warships thoroughly on their guard, the submarines turned their attention to merchantmen and did most of their work on the surface. Only a decimal percentage of merchantmen in those days were armed, so that a U-boat could usually secure a victim by firing a warning round to bring her to, a boat's crew being then sent aboard to place two or three bombs and open the sea-cocks.

The arming of merchantmen forced the Germans to change these tactics. A submarine is very susceptible to damage, and it is the constant aim of U-boat commanders to avoid the risk of it. This spirit has naturally reached its highest development in the German submarine service, whose traditions, such as they are, have been built up almost entirely upon the sinking of defenceless merchantmen and the murder of non-combatants. The consequence was that as the arming of merchantmen was developed the submarine showed less and less inclination for surface work, and depended to a much smaller extent upon the gun and more upon the torpedo. Broadly speaking, this was in the merchantman's favor, because the torpedo is costly and often erratic, and may be avoided if its track be sighted in time, while the U-boat's capacity for destruction per voyage was greatly reduced owing to the small number of missiles that could be carried. This has been met to some extent by increasing the size of the boats, some of which now store as many as 20 torpedoes.

On the other hand, driving the U-boat under water added considerably to the difficulties of the hunt. Great increases in the surface patrols became necessary to take advantage of the fewer appearances of the U-boat on the surface. The hydrophone, an instrument for the detection of submerged sounds (both as to their direction and approximate distance) was rapidly improved to meet the situation. Aircraft were requisitioned in large numbers for scouting and bombing work, and kite balloons are frequently attached to convoys to give early warning of the neighborhood of a U-boat, whether on the surface or submerged. The systematic development of the minefield has further added enormously to the hazard of the submarine's work.

The speed and maneuvering power of specialized "chasers" are now so great, and the destructive force of the depth bomb so wide-spreading, that it virtually amounts to suicide for a U-boat to dive within sight of one of these craft. Let us take the actual position when the two spot each other. The submarine—this is a point most often overlooked—is probably not inferior in armament to anything except really up-to-date destroyers. The usual armament for submarines is either one 4.1-inch 35½-pounder and one 3.4-inch 22-pounder, or a pair of either of these weapons; but a year or so ago Germany began putting into service vessels armed with two 5.9-inch 101½-pounders and two 3.4-inch, as compared with which we have to consider the three 4-inch 31-pounders of British and four 4-inch 33-pounders of United States destroyers building early in the war. Admiral Benson, Chief of Operations, declared last September that Germany was believed to have boats of 5,000 tons in service, and M. Leygues, French Minister of Marine, stated in May that the Germans were "about to launch a new series of submarine cruisers of great size." Either of these craft would probably carry a considerably heavier armament than that already enumerated.

Gunpowder is of use only on the surface; and it looks as if the Germans had begun to find the underseas too warm for them. A "super-submarine" is better armed than an average destroyer or chaser, and infinitely better than the drifters that have been employed against the U-boats in such large numbers, and owe their success to the weapons they can bring to bear on a submerged vessel. A well-armed U-boat that meets an Allied surface warship may either fight or dive. She cannot dive and at the same time maneuver to avoid ramming. During the diving operation she is at the mercy of the other's guns without possibility of reply; and when she has submerged, her worst enemy, the depth bomb, will begin to play about her.

And what if she stays on the surface and fights it out? In gun-power she is probably superior; she presents a much smaller target, and her exposed parts are probably fairly well armored, while those of a destroyer are very unlikely to be; she probably makes as steady a gun-platform as her opponent; and her speed is probably sufficient to enable her to avoid ramming if her gunfire permitted the other to attempt such tactics. The main consideration tending to drive her under water will be the knowledge that if she is badly holed she may be sunk or rendered incapable of diving; yet her adversary runs at least an equal risk of being sunk, and is not able to dive at all. Besides, if they are at anything like close quarters and the U-boat does dive, her doom is as certain as anything well can be.

Can it, then, be regarded as altogether paradoxical to argue that the safest place for enemy submarines is on the surface? I think not; and from the way the Germans are arming their latest boats they seem to think the same. Obviously, a submarine that can stand up to a destroyer in open fight, *and can resist the temptation to dive*, will need something above the grade of the average present-day destroyer to deal with her.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Unsinkable Ships

To the Editor of the SCIENTIFIC AMERICAN:

I am a practical ship builder of about forty years experience, including all types of vessels, both steel and wood, from a yawl boat to the Battleship "Nebraska."

I have in mind a type of cargo vessel that would be, I believe, safer than the present type of cargo ship now being built by the Government, particularly against torpedo attack in carrying food-stuff.

Without going into details now, I would like to find out if it is a demonstrated fact that, when a compartment in the hold of a cargo ship stowed solid with wheat or other food-stuff is torpedoed, the expanding gas actually blows the hatches off to give vent. Is it found that such loose hatches materially relieve the pressure on the bulkheads or other structural parts of the compartment? If you can give me any facts in connection with actual occurrences I will be much obliged. I am as competent as any to theorize on the question.

The plan I have in mind contemplates as one of the details, water and air-tight hatches, and my judgment is that where a compartment of a ship is stowed solid with grain or other food-stuff the question of extent of damage by explosion of torpedo would be quite immaterial, whether the hatch was bolted down water-tight or whether the hatches were closed as is usual, that is, comparatively loosely held so they are free to be lifted by the expanding gasses.

I do not believe the Government is building the best type of freighter for the greatest possible defense against the torpedo. The ships now building are not materially different from those built prior to the war. What I have in mind refers to a ship that will be safer for carrying *particularly food-stuff*, which has an irreparable value when lost.

Briefly, taking the Government's standardized freighter, I would cut the entire upper structures down to a point, say, three or four feet above the load draft line and *deck over "whaleback" fashion from bow to stern.* Fit a stout hand rail fore and aft, giving a fair weather walk-way about six feet wide from bow to stern. A periscope for steering from below deck. A ventilation cowl in the form of a short steel mast, which might include in its construction an observation platform with auxiliary steering gear for use in fair weather. For propulsion I would fit a number of oil engines, say five, close back in the stern, with living quarters for crew next forward of engine room, leaving the balance of the entire ship for cargo. If this vessel's rudder was damaged she could be readily steered with the two outboard engines. A fixed defense gun forward and one aft on deck.

I would cut the balance of ship up into water-tight compartments with a thwartship bulkhead about every twenty-four feet, over each compartment to be fitted a reinforced steel plate hatch cover, say 6 x 8 to 10 feet bolted down flush on deck and water-tight.

As a torpedo to be effective must strike the ship low down, I would have installed in the engine room an air compressor with storage tank, with air pipes leading to each compartment, so that when any one of the compartments was torpedoed, compressed air could be used to force the water out of such compartment down to the top of the break in hull, so that the displacement due to the damaged compartment would be reduced to a minimum. Such a vessel would, of course, depend on dock cranes for loading and unloading, and would not be available for large bulky cargo, as the hatches would be small, though of ample size to handle all food-stuff.

The question as to whether it would be advisable to build such a vessel as large as the standardized ship or in small units, I leave for further consideration, although I incline to the smaller unit as proportionately safer.

The main points for defense as I see them are, first, that the vessel be made as nearly invisible at sea as possible. This would be accomplished by the low freeboard and oil engines. Second, that the damage done by one torpedo be confined to as small a radius as possible. This is done by the multiple bulkhead system and compressed air.

It seems to me that it might be necessary for such a vessel to be struck with as many as six torpedoes before sinking. The present ships when struck in the boiler or engine rooms generally sink.

As to cost, I believe the removal of all structures above the line I propose would more than cover the increased cost of extra bulkheading, and that such a ship would have greater cargo capacity than the present ship and could be built in quicker time. You take the plans of the present standardized freighter the Government is building, cut her down and show her as I describe, and I believe the result will be a more efficient vessel for the purpose of war—not for times of peace. She would not be a good type of excursion boat in bad weather though she would be a good, safe sea vessel and much more comfortable for the crew than her enemy, the submarine.

I have gone more into detail with this than I intended to at the start.

ROBERT MORAN.

Seattle, Wash.

[*We have no data on the question of the action of the explosion on hatches. It is probable that hatches lightly secured would be lifted, even if the hold were stowed solid. Unquestionably loose hatches would tend to relieve the gas pressure in the torpedoed hold.*—EDITOR.]

Meeting the Armored Airplane

To the Editor of the SCIENTIFIC AMERICAN:

In view of the new armored airplanes of German make, I should like to submit an idea for your readers that might be worked up into a very efficient weapon of offence against these machines.

In connection with any of the standard types of airplane machine-guns, and mounted integrally in such a way that both barrels shall be in the same alinement, have a small bore breech loading cannon of say two inches in diameter, firing an impact explosive or incendiary shell.

The action of the adjacent guns would be this: When swooping down upon an enemy with the machine gun "wide open" the aviator has a fairly good idea of where his shots are going by the time he is within point blank range, and at just that instant when he must either swerve abruptly away or collide with him. At that critical moment, if the gun mechanism were so arranged that by an additional half-inch pull of the trigger the heavier gun could be discharged, the shell would strike in the same spot that the previous machine gun bullet landed; since both guns are rigidly mounted together and always pointing in the same direction.

The machine gun would serve primarily as a "finder" for the heavier gun, and incidently has a chance of striking a vulnerable spot, while the shell would pierce any armor that an airplane could carry. The heavier gun would of course, be equipped with a recoil absorbing device.

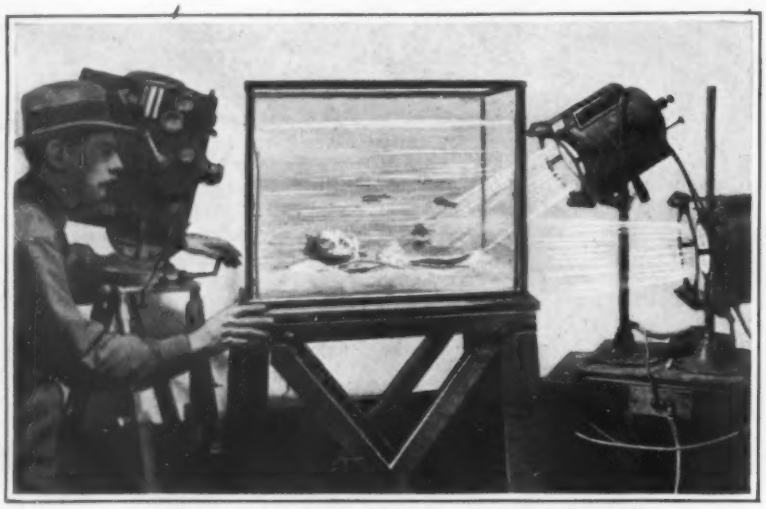
ELTON H. REMINGTON.

Beverly, Mass.

Filming Marine Life

How Curator Ditmars Makes Motion-Picture Studies of Aquaria for the Screen

WAR films of the ordinary sort have been a feature of numerous moving picture theaters for many months. The other day, however, in a large New York public school, the children sat spellbound while they witnessed on the screen a most unusual and exciting war film from the realm of nature. They depicted as veritable a gas attack as any which has taken place at the European battle front; only the actor was not human, but a sea triton. One difference, however, was noticed between the hostile acts of this strange creature and human warfare; nature has made the gasser immune to its own gas. Thus, it is able quite safely to surround itself with an irritating cloud of poisonous vapor through which the attacking member cannot venture.



Curator Ditmars filming one of his remarkable marine studies for the motion-picture screen

But this gas attack was not the only picture that demonstrated the wild creatures under the sea to be quite familiar with the formidable methods which mankind now uses in warfare. There is almost endless variety. Bombardments, gas attacks, shocks by electric current, methods of "digging in" and curious phases of protective decoration that make our much-advertised camouflage look old and mighty cheap.

For camouflage on the sea bottom is evidently as old as the hills, and, as these movies show, there is plenty of it practiced and of the most ingenious type. A crab is seen fastening sponges on his back in order to look like a bit of rock. Then again there is the hermit crab that selects a shell as its abode, which it drags about wherever it goes—and is very painstaking to find a shell that is old and coated with weedy growth so that no one will bother to take notice of it or come nosing around in search of something to eat. Some types instantly transform themselves from the outlines of typical sea creatures to those of a rock or dead branch of coral, and thus remain until danger is past. There are others that can instantly change color in a most marvelous manner, to mimic exactly their surroundings, whatever these may be.

Two submarine motion-picture studies: Picturesque scene of life on the bottom, at the left; and a fight to the death between a huge sea turtle and a devil fish, at the right

Nor are camouflage and gas attacks the only parallels revealed between warfare as practised by deep sea denizens and by human beings, with what we are pleased to regard as modern human inventions. There is the smoke cloud method of concealment. A group of squids, which look like elongaged devilfish but are inoffensive types, are attacked by some carnivorous fish. Several of them instantaneously "dig in," and as they disappear in the soft and yielding sand the enemy passes them by.

But part of the group is not so successful, having in their fright and haste retreated to solid rocky ground where they cannot "dig in." Immediately there is a veritable bombardment of round black clouds, shot in every direction. These clouds are of "sepia," the substance from which we obtain waterproof or drawing ink. The locality of the defenders grows black and murky; the squid disappear in an impenetrable "smoke cloud." In the shelter of this they quickly feel for crevices in the rocks and thus escape the enemy. Their defence is rivalled by the actions of an electric fish that from external appearances looks perfectly harmless. Seized by an enemy it releases a powerful electric shock that sends the burly adversary reeling to one side and with all ideas of further attack eliminated.

Scenes of combat under water have been produced in these movies that rival the pen pictures of Jules Verne. A battle to the death between a giant devilfish and a huge sea turtle is shown. Few creatures escape attack by the devilfish, and it is noticeable that most of them give this repulsive creature a wide birth.

The turtle, however, ventures to give battle when the devilfish attempts to interfere with his orderly existance and, by reason of his protective shell, is able to put up a very hard fight for life. But the head and long neck which he is obliged to put out of his shell to see his way and to bite his enemy are his vulnerable points and the devilfish is quick to realize the fact. Waiting its opportunity, it stretches forth one of its repulsive clinging arms and encircles the turtle's neck, thus quickly choking the life out of its adversary.

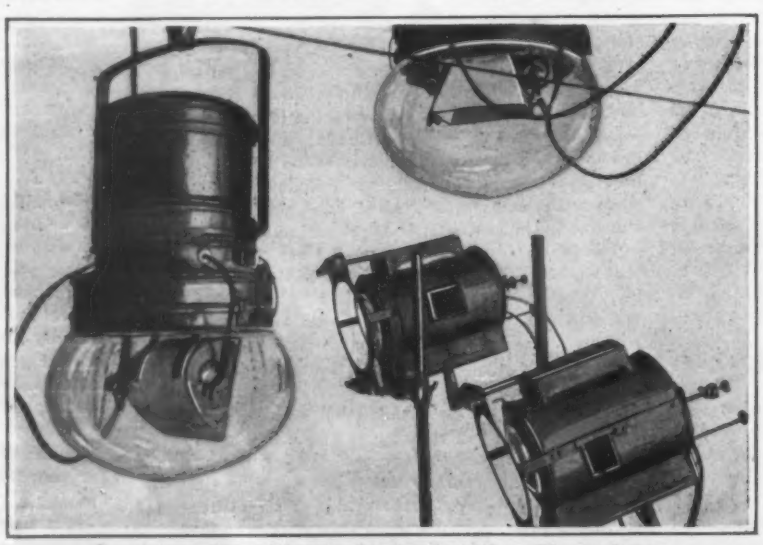
Who would imagine that lobsters fight, according to the Marquis of Queensberry prize ring rules? These movies show a pair of giant deep-sea lobsters having a very orderly bout in what appears to be rounds, and before each set-to the principals appear to shake hands in a most friendly manner. Perhaps, if this hand shaking was scientifically explained, it would be shown that it was merely a phase of lobster combat; to the casual observer, there is a true sporting atmosphere about the scene.

Particularly astonishing are the antics of the lowly clams and scallops. These are seen to be active and really thinking creatures. They swim away from attack in lively fashion, cut up all sorts of capers in changing base, and when disturbed shoot into the sand as if fired from a gun. How they are able to do this is clearly shown. Evidently they are anything but the dull shellfish we imagine them to be.

When the big motion picture men want to get a special thrill in a silent drama of the sea they send expensive companies to Bermuda or Nassau and spend months still-hunting the queer creatures that dwell upon the floor of warm seas. So it might be supposed that these educational films were taken under similar circumstances. A considerable surprise is, therefore, awaiting the curious when it is stated that all these very remarkable photographs were taken many miles from the sea in a number of huge tanks built in Scarsdale, N. Y., at the home of Raymond L. Ditmars, a curator of the New York Zoological Gardens and a well known Naturalist.

When Mr. Ditmars determined to make some marine movies which would thrillingly picture deep sea life, he first made a series of experiments by the sea. Along the shore, it was found possible, during the time of the brightest sunlight, to photograph the sandy bottom at a moderate depth. This was done with apparatus something like a huge megaphone. The end of the contrivance was covered with glass. All sorts of strange life were portrayed, but many and even more curious and interesting forms were observed at a depth too great to be filmed, as Mr. Ditmars found it impossible to get his camera to the bottom. So he decided to set up a marine jungle in his own laboratory.

To do this a number of enormous plate glass tanks were built and so constructed that the water could be heated to the temperature exactly necessary to some forms of marine life and chilled to the point required by others. Sea water of a clarity found some distances out at sea was brought to shore and carried in big cans to the studio. In this rare and curious specimens of marine life, were also transported.



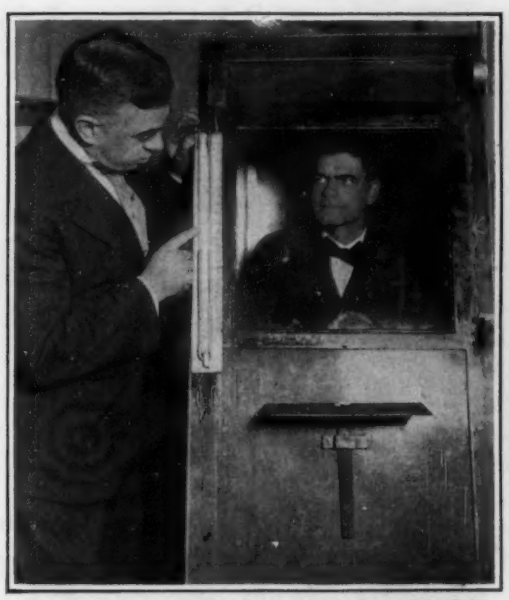
Complete equipment for illuminating the tanks. The arc lamps average 40,000 candlepower each

Next a great quantity of rocks and marine plants was brought to the laboratory. The idea of this was to arrange many kinds of settings. To produce the pictures Mr. Ditmars had in mind, the interiors of the big tanks were arranged with the same care as a stage. In one scene the effect was produced of the sea jungles of waving growth in which roams the devilfish, and the caves wherein these monsters lurk. Then there was material for rocky labyrinths where the shy fish find shelter, sea prairies where the crab legions congregate, and the walls of the reefs on which live the beautiful corals, star fish and sea urchins.

Special settings were also arranged for what Mr. Ditmars declares to be one of the most remarkable creatures he ever captured. This is the smoking caterpillar, an animal that walks about on the sea bottom,

(*Concluded on page 21*)

Not a medieval torture chamber—merely a cabinet for testing aviation candidates



The gage that tells the doctor what the "altitude" is inside the cabinet

The mechanism by which the aviator's testing cabinet is made airtight when closed

Making Airmen Surprise-Proof

By Robert H. Moulton

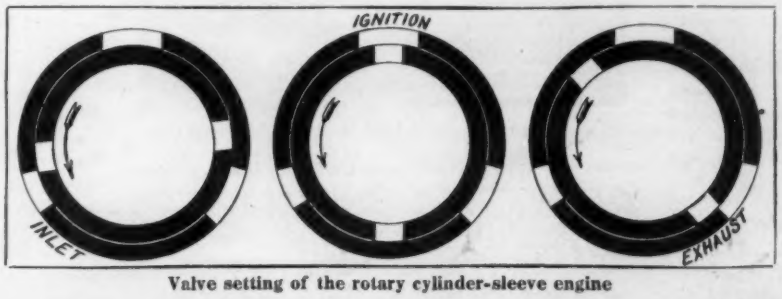
WHEN the war began it was considered that a machine capable of going 60 miles an hour was about all that could reasonably be expected and that an ascension to a height of 10,000 feet in half an hour was a remarkable performance. Furthermore, in order to leave the earth's surface the plane was forced to gain momentum by running on the ground for several hundred feet before it could take the air. At the present time, a machine, to be considered efficient, must be able to leave the ground almost instantly and climb at the rate of 1,000 feet per minute, while its speed varies from 100 to 200 miles per hour. The exigencies of the war have made it evident that we must have the fastest machines if we are to be masters of the air, for no matter how expert our pilots might be, they would be helpless in planes slower than those of the enemy.

It is not only faster machines that we must have, however; it is equally important that we should have superior men in these machines that they may out-maneuver enemy pilots and bring them within range of their gunfire. To meet this requirement it is necessary to have men who are mechanically and physically fit. They must have good respiratory organs, open Eustachian tubes and a perfect ear with normal vestibular apparatus, as well as a perfect body. To this end the government has exercised the greatest care in selecting men for this branch of the service and has conducted very rigid tests of the aviator applicant. The vestibular tests have been carried on to show that each man has a normal labyrinth as confirmed by rotation tests. But with all this, it has not been possible to show what would be the condition of the applicant in actual flying.

Working with this in mind, Dr. Charles M. Robertson, a Chicago physician, has devised a steel cabinet which reproduces the atmospheric changes encountered in actual flying, and is now ready to offer his invention to the government. By the use of this device, examiners are enabled to tell exactly how applicants will act when one, two, three, four or five thousand feet in the air. They can test the heart action after a sudden drop from 6,000 to 1,000 feet, or after a jump of 2,000 feet in ten seconds, and watch the would-be aviator closely for symptoms of paralysis, dizziness, or lack of control.

Dr. Robertson is of the belief, based on extended investigations, that at least 50 per cent of airplane falls in actual warfare are the fault of the operators. A sound body is well enough, he says, but individuals act differently when in the air. For this reason it is extremely important to find out what a man will do when forced to drop two or three thousand feet under fire, or in jockeying to secure the advantage over an opponent. It is obvious that the applicant should be tested as to his ability to stand atmospheric changes. But heretofore there has been no means by which this could be done.

For the ordinary close-to-earth maneuvering a man does not need to be so fully adjusted, for he is in a medium of air almost the same in density and condition as when actually on the earth's surface. This does not hold true, however, of the aviator who ascends a thousand feet or more, because at these altitudes he experiences varying conditions of density and temperature. Were it the practice of aviators to ascend to and descend from any given height at a moderate rate of speed they might not have to be chosen with so much care. But inasmuch as the changes in altitude are frequently very great and are made suddenly, the flyer is subjected to violent variations of air pressure and temperature within the space of a few seconds.



Valve setting of the rotary cylinder-sleeve engine

That this fact is recognized by the makers of airplane engines is shown in the construction of the carburetors of such engines. Thus it is necessary to have a regulating device which at 15,000 feet, for instance, will feed three times the amount of air in the mixture that is required at the earth's surface. Furthermore, the temperature at 25,000 feet altitude is below zero, while the sun's rays register 140 degrees Fahrenheit. Hence an aviator at this height may have his feet frozen and his face

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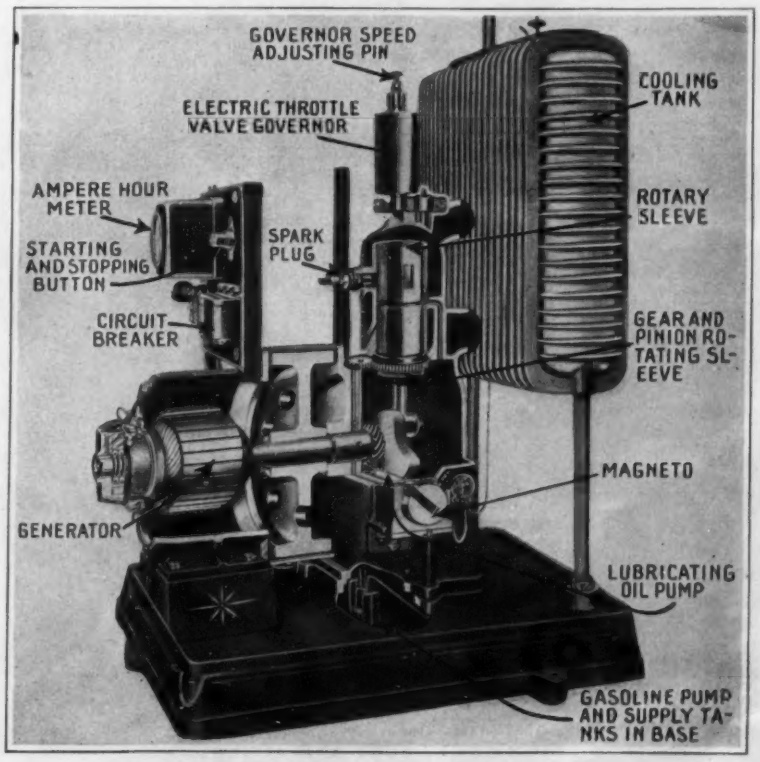


A self-controlling electric generating unit for farm use

Electric Light and Power for the Farmer

IT is entirely unnecessary to dilate upon the advantages to the farmer of electric light and of electric power for the operation of his machinery. Wherever electricity is available at reasonable rates it is being made use of very freely by our farmers. It is to supply the same advantages to the farmer who is not so fortunately situated that the electric power generating unit here illustrated has been designed.

Electricity is such a mysterious power that there is a natural hesitancy on the part of the novice to install electrical machinery. As an offset against this handicap the generating unit in question has been made almost entirely automatic. It takes care of itself to such an extent that even the oil-can may be dispensed with; for the unit is self-lubricating.

The outfit consists of a gasoline engine directly connected with a generator capable of delivering about a thousand watts. In connection with the generator, there is a storage battery which serves as a reservoir for surplus power, and the apparatus is so designed that when the storage battery is completely charged the engine automatically stops.

The gasoline engine is of the two-cycle type without poppet valves, and hence requires practically no attention. A novel valve mechanism is used however. The cylinder itself forms the valve. It consists of two parts: a cylinder sleeve, in which the piston reciprocates, and a cylinder casing in which the sleeve rotates at one-fourth the speed of the crank shaft of the engine. In this rotating sleeve there are two ports arranged to register at predetermined intervals with ports in the cylinder housing. There are three ports in the casing: One is the inlet, another the exhaust, and the third, the ignition. The arrangement is shown diagrammatically in one of our drawings. First, one of the ports in the sleeve registers with the inlet opening, admitting the explosive mixture into the cylinder. After this has been compressed the other port of the sleeve lines up with the ignition port in the housing, and the charge is fired. Finally, the first port in the sleeve registers with the exhaust port of the casing and the products of combusion pass out of the cylinder. Then, the cycle of operations is repeated, but this time the second port of the cylinder registers first with the inlet and then with the exhaust of the cylinder housing, while the first port of the cylinder registers with the ignition opening in the housing. This makes a very silent, steady valve action, which is not subject to uneven wear and avoids the danger of breakage of springs. As the piston reciprocates within the rotary sleeve its motion with respect to the sleeve is relatively spiral; so that such wear as occurs is evenly distributed throughout the cylinder.

As in all rotary sleeve engines, the matter of lubrication requires considerable attention. In the present case, forced lubrication is used. The crank pit serves as a reservoir for oil, and the oil is picked up by a gear pump which feeds it to the cylinder under a pressure of 30 pounds to the square inch. The lubricating

(Concluded on page 23)

The Heavens in July, 1918

The New Star Which Has Flamed Forth in the Eastern Skies

By Prof. Henry Norris Russell, Ph. D.

FEW reports of the observations of the recent solar eclipse have yet appeared in astronomical circles. The weather appears, in general, to have been much less favorable than it was for the last eclipse visible in this country, that of 1900. At Denver it was wholly cloudy; the Naval Observatory party in Oregon secured observations through the clouds; and others appear to have been similarly troubled. The party from Harvard actually had a race with the clouds in a fast automobile, and incidentally, they won this race. Detailed reports will doubtless appear in a few weeks more.

Nova Aquilae

Meanwhile, the day of the eclipse, by a singular coincidence, was signalized by an even more unusual phenomenon—the appearance of a new star, brighter than any which had been seen for three centuries. So conspicuous an object naturally attracted attention in many quarters, and its discovery was announced independently by a dozen or more observers in widely scattered places. So far as the evidence now in hand goes, it appears to have been seen first in Germany, doubtless because it rose for observers in that part of the world an hour or so earlier than in western Europe, and six hours earlier than in our eastern states. It may that some observer in Russia, India, or the Far East will prove to have detected the Nova still earlier.

On the night of June 8th, after the eclipse, the star was of magnitude 0.5—about as bright as Procyon, and nearly equal to Vega. On the ninth it had increased fully five-fold, and was of magnitude 1.4, almost as bright as Sirius, and far brighter than any other star visible in our latitude. Since then it has been gradually fading, and by the 20th it was of the second magnitude—still a conspicuous object, but no longer so bright as to attract the attention of anyone at a glance.

It is admirably placed for observation, being in the constellation Aquila, almost on the celestial equator, and about 15 degrees south and west of Altair. It may readily be found with the aid of our star map, about half way between the stars Delta and Lambda Aquilae, and a little west of the line joining them.

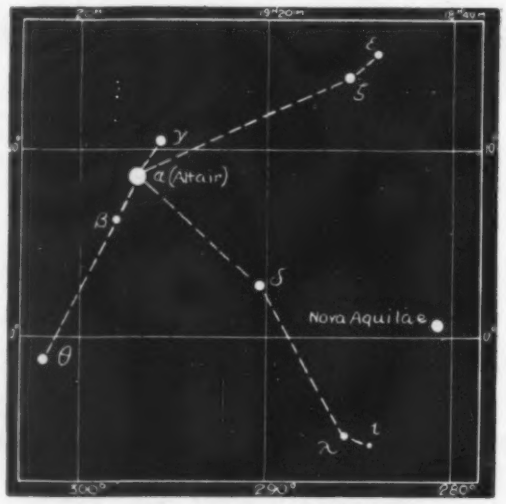
To judge by the analogy of previous novae, it will probably remain visible to the naked eye for several weeks—perhaps even months—gradually diminishing in brightness. Its waning light will be of great interest to watch, and can be followed without instrumental aid of any sort.

The previous history of this star appears fortunately to be unusually well recorded in the great Harvard Library of photographs. It was photographed as a star of the eleventh magnitude on several hundred plates taken between 1888 and the present time, and showed small fluctuations in brightness from time to time, which are being carefully investigated. On June 3d of the present year it was still of the normal brightness. The next three days were cloudy at Harvard. A photograph taken on the 6th showed this star of the sixth magnitude, one hundred times its previous brightness. The next night it was about two hundred times brighter yet and was one of the most conspicuous objects in the sky; and a day later it was near maximum, a hundred thousand times brighter than the week before. During that one day it gave out more light than it had done in the 250 years previous to the outburst (if one may take the last thirty of these as a fair sample).

Observations of every sort have, of course, been made in great abundance upon this remarkable object; but all that has been published up to date of writing relates to the first day or two of its visibility. At this time it showed a spectrum of the "first type" resembling that of Sirius—with narrow dark lines of hydrogen. By the present time it has doubtless changed to the typical nova spectrum, with broad bright and dark bands. It is much to be hoped that sufficiently numerous observations have been secured in different longitudes to make it possible to follow the rapid changes in the spectrum near the time of maximum brightness of the star.

The changes which occur during decreasing light are well known. All novæ, when just past their maxima, show the characteristic spectrum just described, which is very similar in all cases and like that of nothing else in the heavens. As the stars fade in brightness the characteristic lines of the gaseous nebulae become prominent in their spectra, and remain visible for years; but at last, as recent observations at Mt. Wilson show, these too fade away, leaving the spectrum of the well known "Wolf-Rayet" type, which is characteristic of a considerable number of stars in the milky way—all being stars that do not vary in brightness.

But only two novae, previous to this one, were caught "on the rise" so that their spectra could be photographed before they reached maximum. Both of these, Nova Persei of 1901 and the more recent Nova Geminorum, showed at this time a continuous spectrum crossed by dark lines, much like that of a normal star. The spectrum of Nova Persei was of the helium type (technically called B8, and resembling that of the bright star Rigel) while that of Nova Geminorum was of the type F5, very like that of Procyon. This latest addition to the list



The New Star in Aquila

appears to have shown a spectrum intermediate between the two stars. It will be of the greatest interest to learn whether the spectrum changed from one of the familiar types into another as the brightness increased, or remained unaltered until the bright band appeared in it.

What Is a Nova?

There is good reason to hope that the observations which have been secured of this brilliant object, which was so bright as to announce its own appearance without the need of astronomical telegrams, will help to solve the difficult problem of the nature of these extraordinary outbursts of light. When their real magnitude is considered, these are the most spectacular of all known phenomena. The other novae which have appeared in recent years have been found to be very remote, their average distance being at least 150 light years, and probably considerably more; and it does not seem likely that the present object is an exception to this rule. But if it is no more distant than 100 light years, it must at maximum have been at least five thousand times as bright as the sun—and this is probably an underestimate. How can such a terrific outburst of light and heat be developed within two or three days? And, when once it has taken place, why does the star which has thus become so brilliant fade away again, usually to a hundredth part of its greatest light after a few weeks, and almost to its original low estate after a few years?

No theory has yet been developed which will fully account for all the facts; but two things at least seem to be practically certain. First, the outburst, whatever it is, is a superficial phenomenon. It must be only the surface of the star, and not the whole huge mass of its interior, which becomes heated to a degree that would account for the amazing brilliancy. The reason for believing this is the rapidity with which the light fades. If the whole mass of the star were heated as hot as the surface, we might expect it to keep on shining brightly for years—perhaps for centuries.

Secondly, these outbursts are by no means unusual occurrences. It is only 17 years since the appearance of a temporary star in Perseus, almost as bright as this one, and in the interval have been seen at least four others which would have been visible to the naked eye if they had been discovered before they reached their maximum brightness. Add to this the further ones, visible only with the telescopes, and it appears that such outbursts must occur somewhere among the stars every year or two.

These two conclusions dispose entirely of two theories which at first might attract attention. The first is that of a collision between two stars. The stars are such exceedingly small bodies, in comparison with the distances between them, that it can easily be shown that, even if we include all the hundreds of millions of known stars, the average intervals between collisions must be many millions of years, while temporary stars appear every year or two. Moreover, a collision would heat up the whole mass of the colliding bodies, unless it happened to be a merely grazing impact; and even this would produce a mass of furiously incandescent matter so huge that it would shine for a long time.

The other plausible hypothesis, which fares little better at the hands of the facts, is that of an internal explosion, due for instance, to the sudden liberation of radio-active energy within a star. We cannot, of course, make any estimate of how often such a catastrophe might occur among the stars, if indeed it be possible at all. But if it did happen, it would again involve the whole mass of the star and presumably produce long-lived consequences.

Fortunately, there is a theory which escapes these objections, and which fits most of the observed facts excellently. This is the idea, first proposed by Seeliger, that the cause of the disturbance is a collision between a star and a nebula. In this case, the nebular material would be attracted by the star, and rain down into the star's atmosphere with a very high velocity, producing an enormous meteoric shower all over its surface, which would heat the outer layers in a few hours or days to a very high temperature. As soon as the bombardment ceased, the surface would begin to cool; and the heat layer being only skin deep, a few years would see it pretty well cooled off. This accounts for the temporary character of the phenomenon. With respect to the frequency of such occurrences it is only necessary to remark that nebulae are big targets. For a star to enter a nebula is like a bullet hitting a cloud; for two stars to collide in flight would be like two bullets in flight hitting one another.

The theory of collision with a nebula, therefore, accounts for the main features of the affair. But many spectroscopic details remain unexplained. Observations during the rapid rise in brightness may present the clue to the maze; and this time there is good reason to hope that many have been secured.

One word more: we must be careful not to think of the great stellar catastrophe as having actually occurred on the day of the eclipse. The light by which we saw it had been on its way certainly for decades, probably for centuries; and it is more

(Concluded on page 24)

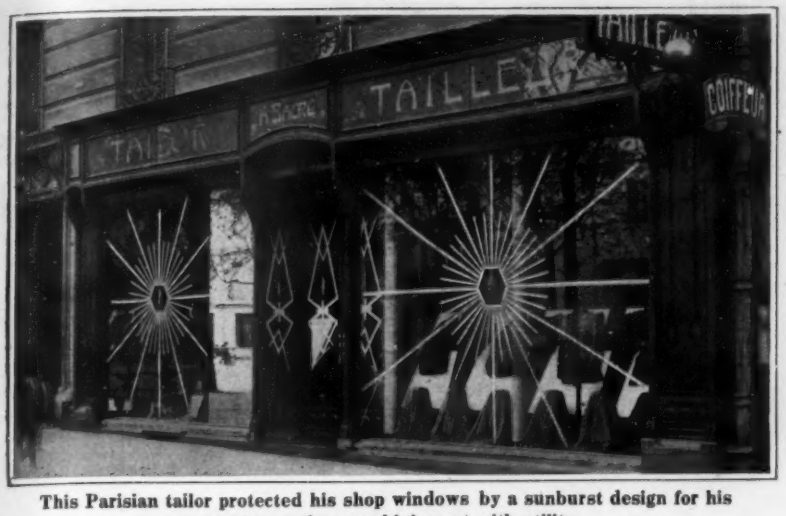
At 12 o'clock, July 7.
At 11½ o'clock: July 14.
At 11 o'clock: July 22.

At 10½ o'clock: July 30.

At 10 o'clock: Aug. 7.
At 9½ o'clock: Aug. 14.
At 9 o'clock: Aug. 22.

The hours given are in summer months time.

NIGHT SKY: JULY AND AUGUST



This Parisian tailor protected his shop windows by a sunburst design for his paper tapes, thus combining art with utility

This jeweler has followed a more conventional lattice-work design, leaving small square windows in line with show cases

Paper Taped Shop Windows of Bombarded Paris

PARISIANS have that most enviable faculty of making the most out of any misfortune. All the world knows it—except the Germans; and that is why the German airmen and artillerymen keep sending missiles into Paris with the object of terrorizing and discouraging the Parisians, without realizing that they are not only failing in their task, but are stirring still greater hatred against them.

So it was that when the German long-range guns began to bombard Paris, the government advised the metropolitan folk to keep their windows open wherever possible, in order to offer the least resistance to the rush of air following the explosion of German shells. In instances where windows could not be opened, particularly plate-glass store fronts, the authorities advised the use of paper tape about four inches wide, carefully and tightly glued on the inside of windows in some diagonal shape to take up the bending stresses of the glass surfaces.

The Parisians followed the instructions. They not only followed them but they went one step further: progressive shop keepers saw the decorative possibilities of the paper tapes and immediately set to work on elaborate designs tending to attract attention to their displayed wares. As a result, there is today in Paris no end to weird window designs which lend a new touch to the city's stores. In fact, the Hun gunners somewhere in the St. Gobain forest are materially boosting Parisian trade by their daily work, even though they may not be aware of this fact.

Second-Hand Store of the Battle-Line

SECOND-HAND dealers do a thriving trade in the war zone. Not only have they no trouble in securing their stocks in regions where the wreckage of war is to be found on all sides, but there is considerable demand on the part of soldiers for various second-hand articles. Then there is a big opportunity for the display of ingenuity: the second-hand dealer can do much in the way of restoring partly or wholly the pieces of wreckage which come to him, thereby increasing their sales value.

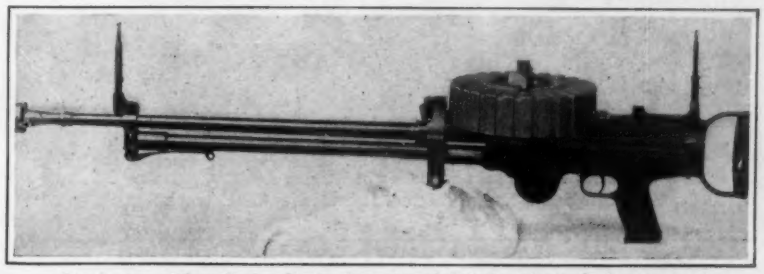
Typical of the battle-line second-hand shop is that depicted in the accompanying illustration, presumably taken at the rear of the Canadian battle-front in France. Here may be seen a Canadian out for bargains and evidently having found one in the shape of an old soft hat. It is said of these second-hand shops that they contain anything from a bird-cage to a cradle, and aside from these two articles the illustration shows a phonograph horn, bicycle frame, chair, floral frames, hot-water bag and several other equally varied objects.

How the Lewis Gun Is Stripped for Service on Aircraft

FOLLOWING the example of British and French fighting aircraft, our own battleplanes are to be equipped with Lewis guns, although recent announcements of the Ordnance Bureau make it plain that the Browning heavy gun and the Marlin aircraft gun are also to be used. But at this very moment it is perhaps safe to state that more Lewis guns have been employed on Allied battleplanes than any other type of gun.

For air service, the Lewis gun is stripped of its characteristic cooling jacket or "hose," because the high speed of the airplanes with the consequent rush of cold air, makes a large cooling surface totally unnecessary. The spade handle is used in place of the ordinary butt stock, greatly facilitating the quick handling of the gun by the fighting aviator. Another change is to be found in the sights, which in this case consist of a bead at the front end and a fairly large ring at the rear—an arrangement which is sufficiently accurate under the conditions of aerial warfare.

The Lewis gun is employed on French and British battleplanes as a supplement to the heavier Maxim gun, in the latest planes. The latter is generally a rigidly-mounted piece firing through the propeller by means of a synchronized firing device, while the former or Lewis gun is mounted above the top plane, or on a cradle arrangement in the rear cockpit, where it can be handled by the pilot or the observer, respectively. Either arrangement applies to tractor machines. In the case of pusher planes the Lewis gun is placed on a cradle mounting in front and operated by the observer or gunner. Formerly, the Lewis gun was employed in Nieuport machines above the top plane so as to clear the sweep of the propeller, and was operated by the pilot by means of a Bowden wire control.



Lewis gun stripped of radiating barrel and fitted with spade handle and special sights for airplane work

Copyright, Western Newspaper Union

Canadian buying a hat at a second-hand store near Lens

Copyright, International Film Service

Graphic proof that Germany's aircraft industry is hard pressed: An enemy machine built of steel tubing instead of spruce

Can Germany Keep Up Her Airplane Production?

THERE has been something decidedly impossible about the way in which Germany has maintained her aircraft production. That is to say, despite the large percentage of men called to the colors; despite the demands of other war industries and the farms for labor, whether men or women or children; despite the complete isolation of the German Empire from the outside world, German airplanes have not been found lacking in numbers or in quality in the competition with Great Britain, France, Russia, Italy and the United States.

But presently the mystery is rapidly clearing. Germany, we are about to learn, cannot do the impossible any more than any other nation. The truth is that Germany has put up a plucky fight in the air, but her vast aircraft production is now finding itself hard pressed for labor and materials.

There is undeniable evidence that the Germans are running short of suitable materials, and in consequence are using inferior timber and textiles. Captured German machines exhibit a desperate effort to maintain quantity production at the cost of using poor material and hurried labor. For instance, the wing beams of the captured planes are often made of thin pieces, less than an inch in thickness, put together with glue and nails. American specifications require solid beams of the finest and toughest spruce. Wings of the German planes are covered with a fiber cloth instead of the stout linen used on Allied planes.

We are told that our winged enemies refuse to enter into a combat calling for the usual range of trick flying, because their poorly built machines cannot stand the strains imposed. Rather than accept combat under circumstances calling for other than straight flying, German machines are now said to turn and make off for their lines at full speed. Numerous German planes have been seen to crumple and fall from no other apparent reason than structural defects. Steel tubing, which the Germans are using in increasing quantities for their planes, is proving far inferior to spruce which is now beginning to lack in Germany.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

An Air Screw That Ridicules Propeller Theories

WERE it not for the stern theories regulating the design of air screws, we would not be using propellers today which differ but little from those of the pioneer airplanes. Indeed, while airplanes and engines have been constantly improved during the past ten years, the air screw—the most important member of any aircraft—has remained practically at a standstill, due to the adherence of propeller makers to those orthodox theories which no one dared violate.

It has, therefore, remained for James A. Irving of New York City to disregard most air screw theories and strike forth along new lines. As a result, he has invented a new propeller or tractor screw of radical design, which, according to the testimony of several well-known aviators who have tried it on their machines, presents a definite advance in air screws.

Essentially, Mr. Irving's device is two propellers in one, as will be noted in the accompanying illustrations. In the working model shown, one set of blades is 8 feet 6 inches in diameter, while the other set is about 20 per cent shorter The longer blades may be termed the leading blades, while the shorter ones may be termed the auxiliary blades.

The blades are built up of three-ply ash and mahogany, the latter being laminated crosswise of the grain of the two outside strips of ash; this arrangement, the inventor holds, is a positive insurance against splitting. The blades are mounted upon Monel metal arms the shanks of which are taper fitted to a two-part hub of the same metal, provided with sockets for the purpose. The tapered shanks are drawn home and securely held by means of specially designed lock-nuts, to any desired pitch which may be graduated upon the shanks and hub sockets.

In the side view of the new propeller it will be noted that the arms and blades have a dihedral arrangement, which calls for an explanation. There are four reasons for this design, according to the inventor: First, in effecting centripetal action, drawing and forcing the air to the center, thus eliminating radial slip; second, applied to the auxiliary blades for the purpose of

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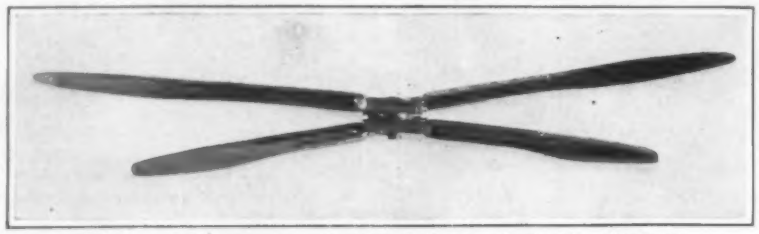
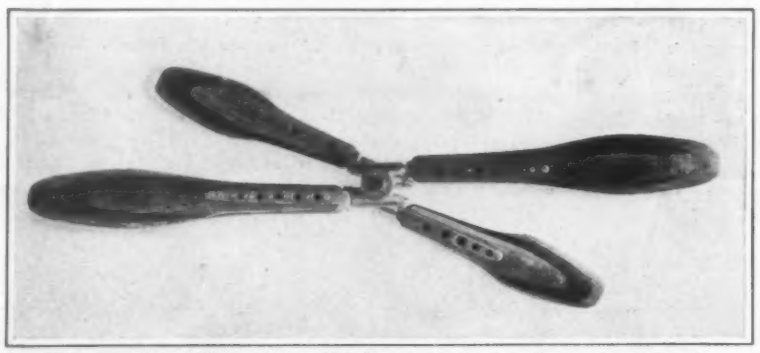


Side view of the new propeller for airplanes, showing the dihedral arrangement of the blades



This propeller, with two sets of blades of varying lengths, is claimed to be 33 per cent more efficient than conventional types

A Collapsible Wash Basin

THE accompanying illustration shows a unique wash basin of the collapsible type, designed to fold into a roll 2 x 8 inches. This is said to be an ideal basin, thoroughly practicable and serviceable for the army outfit, for campers and for motorists. It will be seen that the steel frame is collapsible, but when open holds its shape rigidly. The container is made either of double-coated rubber or of water-repellant canvas. In the former case it has a diameter of 13 inches and a height of 5 inches, with a capacity for one gallon of water. Its weight in this style is but seven ounces. The canvas bag is 15 inches in diameter, with a height of six inches and a capacity of a gallon and a half. It weighs exactly as much as the rubber container.

The collapsible wash-basin for army use

New Type of Reflectless Window

REPRESENTING a new type of the shadow-box window, the large front window of a retail music store in Los Angeles, Cal., which is shown in the accompanying illustration, attracts considerable attention, both because of its uniqueness and because it shows no reflections. As will be observed, the window contains a long section of inward curved glass; and by looking closely it will be noticed that, whereas the lower portion shows reflections of automobiles and other objects stationed along the curb outside, through the curved portion may be clearly seen the musical instruments within. In fact, the arrangement caused the interior to be as distinctly revealed to the passerby as if no glass intervened.

Other shadow-box windows have been designed and used, but this is said to be the only one designed with the glass curved upward, or with the shadow-box above. In other windows the curve is reversed, which naturally is more liable to accumulate dust and dirt, and require more attention to keep clean.

The window is 15 feet in width, and the curved section begins at a height of 36 inches from the pavement. The perpendicular height of the curved portion is 40 inches, and it curves to a depth of 32 inches. It is, of course, of heavy plate-glass.

No idle needle to fall out of the work

The reflectless window that gives high visibility from the sidewalk

Two Knitting Needles in One

THE woman who is knitting today is not the old-fashioned Grandmother-Lady, but she is almost every patriotic woman—young, old or middle-aged, rich or poor. The present necessity for much knitting of warm comforts for our soldiers and sailor lads has led to the invention of a new knitting needle which takes the place of the usual two long needles for straight knitting of a flat surface, such as a muffler, or of the customary set of three or even four short needles commonly used for circular knitting such as the making of socks and helmets.

In the old way one straight needle holds the stitches while a second straight needle is used to lift the yarn off and incorporate it into the new row of stitches by which the garment grows in length. With the new single needle, which is flexible, longer than the old type of single needle, and curved into a circle with two open, pointed ends, the stitches are held upon the curving needle and are knitted off at one end by the use of the second or opposite point. When all the stitches have been worked over to the opposite extremity of the needle the process is continued in a similar manner by the use of the first needle tip, and so the process continues by the use of the two points alternately for the succeeding row of stitches.

The use of the new curved needle results in fewer dropped stitches and there are no projecting points, as in the old method, to punch through the knitting bag or to annoy persons sitting next to a busy knitter on a crowded street car or train. And, there is no idle needle to fall out and be picked up off the floor.

The Use of Patented Inventions by the United States Government

By E. B. Marshall

THE right of the State to acquire private property for public use has always been recognized under the law of eminent domain. This right has existed with reference to patents as well as to other forms of property, the patentee being entitled to adequate compensation under the Constitutional guarantees.

Although this right of compensation is clear, there have been in the past difficulties in certain cases in enforcing the right, for the reason that the United States cannot be sued, except when expressly permitted by statute. The United States could not, therefore, be impleaded because of a wrongful taking of patent rights by one of its officers. Of course, the officer himself who attempted to take such rights in disregard of the Constitutional guarantees was subject as a wrongdoer to be controlled to the extent necessary to protect the rights of the patentee. But it will be understood that in such a suit no relief could be awarded which could not rightfully be granted without impleading the United States or what is equivalent thereto without interfering with the property of the United States possessed or used for the purpose of its governmental functions.

Prior to 1910, the owner of a patent, rights under which had been appropriated for the benefit of the United States by an officer thereof, could in certain cases bring action under a statute on a contract, ex-

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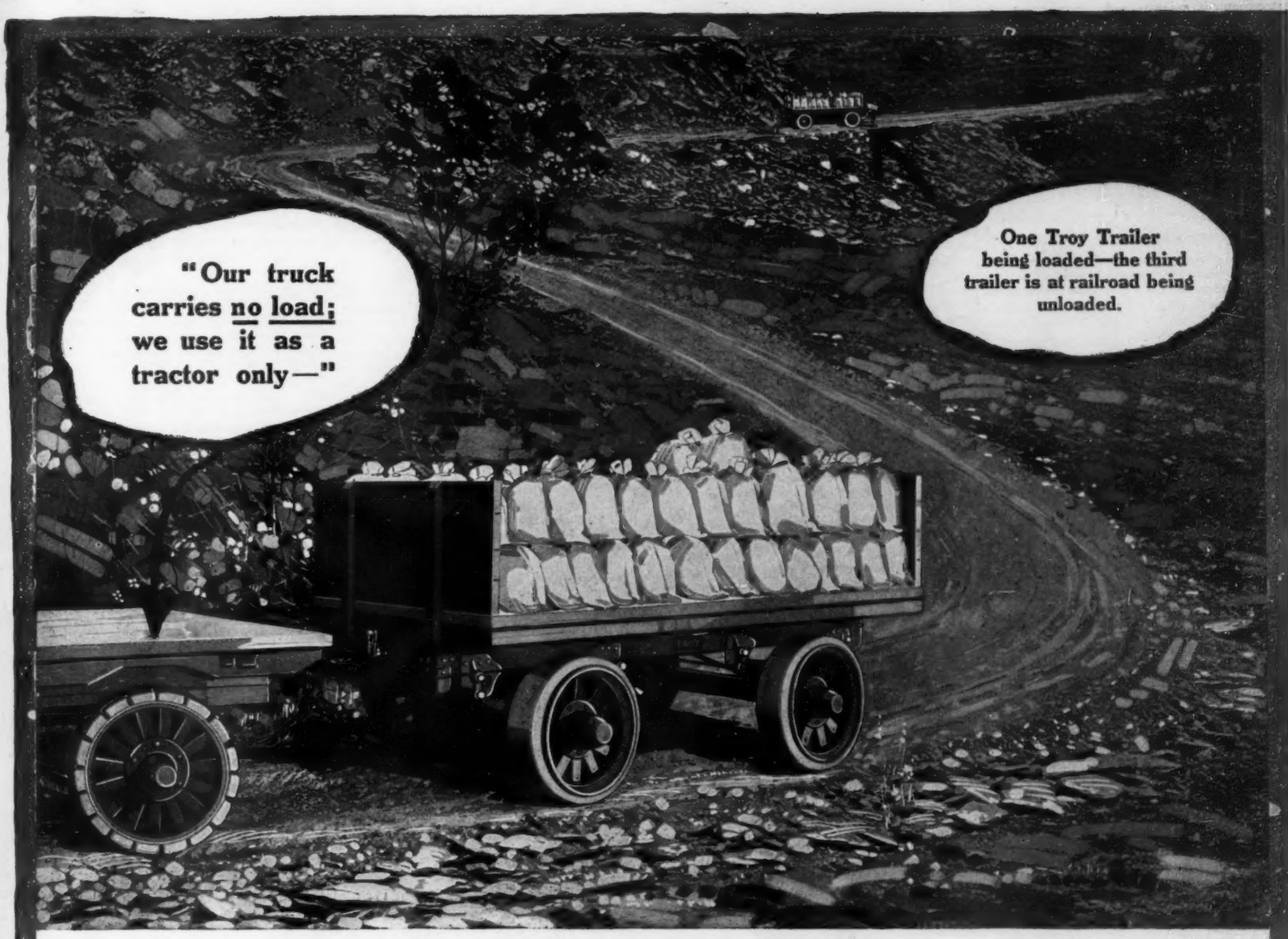

"Our truck carries no load; we use it as a tractor only—"
One Troy Trailer being loaded—the third trailer is at railroad being unloaded.

(Drawing made from actual photograph)

"We can't afford to waste the time it would take to load the truck—"

H. G. Williams, miner and manufacturer of roofing slate at Granville, N. Y., writes:—"I have fully convinced myself that Troy Trailers are the best method of getting efficiency and returns from an auto truck. As we have three Troy Trailers, there is no loss of time whatsoever, one trailer being loaded, another on the way, and the third trailer being unloaded all at the same time. I am positive we have cut our cost more than one-half what it used to be, owing to the time the truck was idle in loading and unloading. We have had no trouble whatever with either truck or trailers. Our roads have very sharp turns, yet cause no inconvenience at all. I would be pleased to have any prospective Troy Trailer buyer come to Granville and see for himself what we are doing, and will gladly assist them in information and data."

"When formerly three trucks hauled only 65 tons a day, our ONE truck and three Troy Trailers now haul 105 tons daily"

This is only one case where Troy Trailers have proven to be the ***real*** and sure method of doubling daily deliveries, while at the same time cutting hauling cost in half.

Motor truck users have felt that the truck was profitable only as a carrier—but here is one manufacturer who has proved that it is a waste of time to put any load at all on his truck.

Hundreds of other truck users will soon be following Mr. Williams' practice when once they seek the ***real facts*** as to hauling economy and efficiency.

Oldest and largest makers of Trailers, making possible highest grade construction at lowest cost

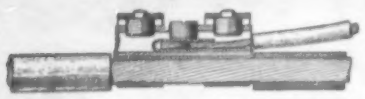
THE TROY WAGON WORKS CO., Troy, Ohio

Troy Trailers

RECENTLY PATENTED INVENTIONS

Electrical Devices

TAP CONNECTOR FOR ELECTRIC CONDUCTORS.—M. F. FINKELSTEIN, 84 Walker St., New York, N. Y. The invention relates to a connector whereby a branch wire can be electrically connected with a main conductor. An object is to provide a clip or clamp arranged within the



LONGITUDINAL SECTION OF THE DEVICE

body of the connector and adapted to receive the end of the branch wire which is securely held by the clamping screw which binds the clamp to the wire. The device is so designed that it is simple and inexpensive to manufacture, and an electrical connection can be easily and quickly made.

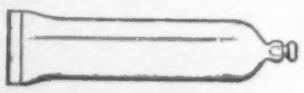
ELECTRIC CONNECTOR.—M. F. FINKELSTEIN, 84 Walker St., New York, N. Y. The general object of the invention is to provide a device which is so designed as to enable two wires to be easily, quickly and securely fastened together. A more specific object is the provision of

A LONGITUDINAL SECTION

a duplex clamp arranged within the tubular body of the connector, the clamp having spring jaws which are held in gripping relation with the conductors or wires by threaded members screwed into the wall of the body of the connector.

Of General Interest

PASTE TUBE.—A. C. CRUMP, 20 W. 50th St., New York, N. Y. The invention relates to containers of the flexible tube type especially adapted for containing paste, although not limited to this use. A specific object is the provision of a single-piece flexible container made of transparent

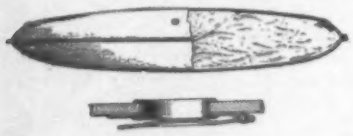


A VIEW OF THE TUBE

celluloid in which the material can be forced in through the mouth under pressure instead of through the open bottom, as is commonly the case. The tube being of celluloid the contents cannot be affected deleteriously, as is liable with a metal tube.

EYE GLASS MOUNT.—DR. C. MEYER, 1425 Broadway, New York, N. Y. The object of the invention is to provide a construction for supporting the lens through the action of interlocking members, slots being provided in the lenses and clamping members fitting into the slots. A further object is to provide a post and guard with connecting means fitting in a plurality of slots arranged at angles to each other.

AIR CUSHION.—H. KAMRASS, 318 7th Ave., New York, N. Y. The invention relates to seats for chairs, its object is to provide an air cushion arranged to produce a desired resilience and ventilation with a view to insure comfort to the user, the cushion having an air valve comprising a flanged eyelet and a piece of flexible material



A SIDE ELEVATION AND SECTION OF AIR VALVE

doubled upon itself and its upper portion having an aperture that receives the eyelet and is secured between the lower flange of the latter and the covering of the cushion, the lower portion of the said piece overlying the inner end of the eyelet and constituting the valve proper.

BANK CHECK PROTECTOR.—W. W. WINTON, 605 Nears Bldg., Washington Ave., Scranton, Pa. Among the principal objects which the invention has in view are, to prevent changing the intent as expressed by writing on a check, to render it substantially impossible to change the engrossing or imprint of a check, to avoid the use of machines the operation of which may be simulated or duplicated. Means are provided for accomplishing the desired result by the use of a color medium placed at the back of the check, the ink deposited by the pen on the one surface of the paper mingling with the body of the ink imparted by the color medium.

BILL BOOK.—J. MACDONALD, 240 W. 23d St. New York, N. Y. The object of the invention is to provide a bill book arranged to securely hold and readily accommodate a large number of bank bills in folded position and without producing an unduly bulky package. Another object is to permit the user to readily open the bill fold for convenient insertion or removal of the bills.

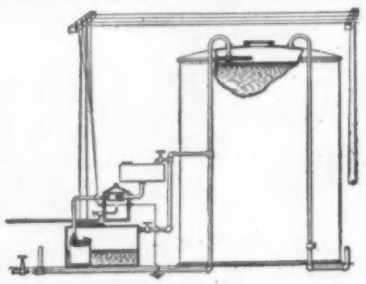
CURTAIN ROD HOLDER.—G. H. EULER, 494 Springfield Ave., Newark, N. J. The object of this invention is to provide a curtain rod holder which is simple in construction and can be conveniently adjusted, it comprises two pairs of elongated members, disposed at the sides of the window frame, brackets are provided, being supported in adjusted position on the elongated members, hooks extend forwardly from the brackets, and rods are disposed upon the hooks, to secure the curtain.

PHOTOGRAPHIC PLATE HOLDER.—S. G. ZUCKERMAN, 205 Central National Bank Bldg., Tulsa, Okla. Among the principal objects of the invention is to provide means for transferring an inscription to a photographic plate, to be developed with the remainder of the negative, the reproduction of which on photographic prints will resemble in character that of pencil or ink on white paper, and to provide for placing the inscription above mentioned upon the field of the photographic print.

AWNING.—O. H. DESMARAIS, address Chas. W. Lockwood, New York Times Office, New York, N. Y. The invention relates to awnings adapted especially for windows, porches, doors or the like, it has particular reference to means whereby the awning may be nested in close position at the top of the opening for which it is provided. The device is adapted to be put up or taken down with facility when in extended position it is held substantially rigid to prevent rattling or flapping, and when collapsed fits into very small compass.

WALL CONCRETE ANCHOR.—H. RUINELLO, 303 Sherman Ave., Jersey City, N. J. The object of the invention is to provide an anchoring device particularly for walls, which will not only act as an anchor, but as a reinforcing and supporting means for the wall. A still further object is to provide an anchor with retaining ears for receiving securing pins, whereby the pins may be easily removed after the wall has been cast.

AUTOMATIC FIRE PREVENTER AND EXTINGUISHER.—H. D. MILLER and S. B. LIPPINCOTT, address Loyal J. Miller, 414 Security Bldg., Oklahoma City, Okla. The object of the invention is to provide mechanism especially adapted for use with oil tanks, or other enclosed



A DIAGRAMMATIC VIEW WITH PARTS IN SECTION

spaces for preventing the igniting of the oil or material, wherein means is provided for generating carbon dioxid gas and for discharging it into the tank, the means being normally inoperative, and controlled by electric discharges or by the rise of temperature above a predetermined point in the tank.

TUBE INJECTOR.—E. J. BRENNESEN, 33 Remsen Ave., Elmhurst, L. I., N. Y. The invention has for an object the provision of a construction whereby an ordinary commercial collapsible tube may be used in connection with the injecting nozzle for dispensing a fluid from the tube as may be desired. Another object is to provide a nozzle which may be screwed on to a collapsible tube after the cap has been removed and provide a liquid-tight connection.

VACUUM CUP.—R. P. RHEINLANDER, 527 W. 143d St., Apt. 33, New York, N. Y. This invention has for an object the provision of a construction wherein the holding cup structure will adhere permanently when once properly positioned. Another object is to provide a vacuum cup structure in which a reinforced ring is connected with the cup in such manner that the reinforcing will take up the strain and distribute it over the cups.

PANORAMIC CAMERA.—S. E. ODELL, 2315 Iron St., Bellingham, Wash. One of the main objects of the invention is to provide an apparatus which permits the use of a lens of any focus without the necessity for changing any of the parts for the reason that the camera revolves throughout a partial or a complete circle. An important object is the provision of means for moving the camera over a support in the form of a transverse table in such manner that the length of film fed during a given period shall equal the distance of camera movement over the table on a circle of which the focal length of the lens is the radius.

Hardware and Tools

TOOL.—L. PIGNANI, address S. W. MILLER, Blairsville, Pa. The invention relates to a combination tool, and more particularly to a wrench to be associated with a hammer. An object is to provide a wrench so formed as to have a wide range of usefulness in accommodating itself to nuts of different sizes, and to provide means coacting with the wrench to lock the latter in position in the hammer.

Heating and Lighting

FURNACE.—J. L. PIERCE, care of H. G. Reed, Manila, P. I. The invention relates to furnaces for different uses though having an especial adaptability for use with driers or evaporators, the main object is to utilize all the heat from the burning fuel by the provision of an arrangement of flues and partition plates whereby the heat of the fire gases is effectively transferred to the air to be heated.

RADIATOR AIR VALVE PROTECTOR.—G. RUDISCHHAUSER, Hotel Maxwell, 220 W. 49th St., New York, N. Y. This invention relates to means for preventing unauthorized persons from manipulating the air valve of a radiator. The device comprises a tubular shell having an open end adapted to admit the air valve so that the air vent is located within the shell, a socket disposed transversely of the shell, and a set screw having an annular head adapted to be located within the socket, the screw being adapted to secure the shell to the radiator, the shell having openings constituting vents.

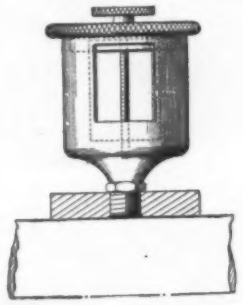
Machines and Mechanical Devices

VENDING MACHINE.—R. MOORE, McFarlan, N. C. The invention relates to vending machines, particularly adapted for selling bottled beverages or other round articles, and while it provides a runway or rack for holding the bottles and means for feeding the bottles to the delivery spout, it may readily be employed for handling other classes of merchandise, provision being made for coin controlled vending mechanism for delivery of any class of merchandise.

CENTRIFUGAL TURBINE PUMP.—C. E. BURRESS, 963 S. Dakota St., Los Angeles, Cal. A specific object of this invention is the provision of a runner construction having impelling tangential blades for forcing up the water, and helical blades for giving direction to the water discharged by the impelling blades, and converting pressure into motion, there being a novel arrangement of packing means for preventing leakage around the runner from the discharge side of the impelling blades to the inlet side of the runner.

MOLDING MACHINE.—F. CURRY and A. F. LEWIS, care of A. G. Balaam, Thomas Bldg., Santa Barbara, Cal. This invention relates to molding machines for molding articles from plastic material, for instance, concrete. An object of the invention is to provide a machine wherein the article manufactured may be compressed evenly throughout for producing uniform stresses, and is finished on the outer and inner surfaces when the article is hollow by a sliding action of the moulding members.

GREASE CUP.—A. E. TOOMEY, Edmore, N. D. The object of the invention is to provide a devise wherein a casing is provided, consisting of an inner and an outer section, rotatably connected to turn with respect to each other, the



A FRONT VIEW OF THE CUP

sections having openings adapted to register when they are turned into a predetermined position to facilitate the filling of the cup, and wherein a plunger is provided for expressing the contents of the cup, the plunger being screw operated.

PNEUMATIC ELEVATOR AND DISTRIBUTER FOR COTTON GINS.—J. L. HART, care of Hart Cotton Machine Co., Chickasha, Okla. The invention has for its object to provide mechanism in connection with systems of the character specified, for governing the air pressure in the said system and for permitting the raw cotton to be drawn from the system and thoroughly cleaned from dirt, and other foreign matter, and returned to the system for distribution to the gins, without interfering with the operation of the system.

Medical Devices

DOSER.—W. H. BAKER, care of H. C. Kirkendall, Cherokee, Okla. The invention relates to devices for administering medicine in a liquid form, and more particularly to instruments for dosing hogs, it has for its object to provide a

VIEW SHOWING USE OF THE INVENTION

device whereby a hog can be easily handled and the medicine easily and more certainly applied internally. The device comprises a jaw spreading member, and a lower jaw clamping member, connected with a flexible tube, and funnel to receive the medicine.

BLOOD DRAINER FOR EMBALMING.—G. H. HURST, JR., 156 Depot Brigade, Infirmary 42, Camp Jackson, S. C. A specific object of the invention is to provide a form of bottle having one or more valve tubes connected with its mouth at the top, which tubes are adapted to be inserted in the arteries of a corpse, and in the bottom of the bottle is a drain pipe having a trap and a valve, so that when the bottle, after being filled with water, is opened by means of the valve in the drain pipe, suction is produced through the tubes at the top, and consequently, as the water flows out, blood will be drawn into the bottle from the corpse without any danger of air entering the arteries or veins.

CAPSULE FILLER.—P. J. FLEMING and R. L. DICKS, address Paul J. Fleming, St. Martinville, La. An object of the invention is to provide a structure wherein one or a number of capsules may be filled with exactly the same amount without the use of complicated weighing or measuring devices. A further object is to provide a filler with a plurality of grooves and means for measuring quantities of material in the grooves after which the measured material may be forced into the capsules by follower plungers without removing the material from the grooves.

Musical Devices

PIANO STRINGS AND FRAMES FOR SAME.—E. FOSTER, The Cottage, Montego Bay, Jamaica, West Indies. The object of the invention is to provide metal tapes in lieu of wires, to facilitate the tuning of the instrument. The use of such tapes will also decrease the hardening of the felt hammers, as they will strike on a larger surface. The tapelike strings are prevented from torsion and lateral movement at their bridges by the engagement of screws with slots in the bars.

Railways and Their Accessories

RAILWAY GATE.—H. RUINELLO, 303 Sherman Ave., Jersey City, N. J. The invention has for an object the provision of a construction which may be operated by the train so as to present a barrier and operated manually to a restored position. Another object is to provide a gate which presents a positive battery against vehicles and which will yieldingly resist a forward movement of the vehicle in case of contact. Normally the gate lies flat in the road but when released will move pivotally upward to a vertical position across the road.

Pertaining to Vehicles

SPRING SUSPENSION FOR AUTOMOBILES.—C. J. ESCALANTE, Apartado 218 Merida, Yucatan, Mexico, via New Orleans and Progress. One of the principal objects of the invention is to provide means, in connection with the side springs connected with the axles and pivotally connected with the vehicle frame, whereby rebounding is reduced to a minimum, this being accomplished by employing a third spring which has its ends connected by shackling means with the side springs adjacent their pivoted ends so that the ends of the third spring yield to a less extent than the movement of the side springs.

PNEUMATIC TIRE CASING.—A. CARTHEUSER, Northfield Ave., West Orange, N. J. Among the objects of the invention are, to protect a pneumatic tire from being punctured, to provide a frictional tread protected from puncture and supported in service by the pneumatic tire,

PERSPECTIVE VIEW SHOWING THE CASING ASSOCIATED WITH TIRE

to provide a wearing surface having a number of independently movable members, each directly supported by the pneumatic tire, to provide a solid metallic casing for the pneumatic tire for preventing undue expansion by internal strains.

AUTOMOBILE FENDER.—T. DOUGHERTY, 526 59th St., Brooklyn, N. Y. The invention relates to safety appliances for vehicles, its particular object is to provide an attachment for or to be carried upon the front end of an automobile for the purpose of preventing injury to pedestrians who might otherwise be struck and injured. The device consists of an upright pad and a horizontal pad so related that when vertical pad is forced rearward by impact the horizontal pad will be projected forward to drop into inclined position upon the roadway.

TRACTION WHEEL.—D. A. WALLACE, 704 Ferguson St., Charles City, Iowa. An object of the invention is to provide a traction wheel having means whereby the same can be easily and quickly transformed into an ordinary wheel. The wheel comprises a hub, a rim, shoes and studs at the rim, and having means adapted to project studs through the rim, and means to move the shoes toward the hub.

HOOD FOR AUTOMOBILES.—J. S. MALLORY, 11 S. Main St., Henderson, Ky. The prime object of the invention is to provide a hood with a main ventilating opening and an auxiliary opening, rearward of the main opening, together with shutters controlling the respective openings and so arranged that air may be directed between the forward shutters against the manifold and exhausted through the shutters at the exhaust opening, the respective shutters being adapted to be disposed in various angular positions to completely close the hood in extreme cold weather or to deflect rain or snow while permitting an appreciable degree of ventilation.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Science vs. Guesswork

How "hit-or-miss" lubrication gave way to the scientific use of oils

FRICTION in any power plant—whether steel mill or automobile engine—is the worst enemy of economy and full power.

The practical need for something to reduce friction brought about the first use of lubricants. Fish oils and animal fats were first used.

It was later found that petroleum would yield different types of lubricating oils of marked superiority.

Development in the manufacture of different grades and classes of lubricating oils came at a fortunate time. For mechanical arts developed rapidly.

Unless the lubricating problems were properly met, mechanical development would fail in its aim. Only the properly lubricated engine could yield the efficiency aimed at.

The Vacuum Oil Company were the first manufacturers of petroleum residual lubricants; and were the pioneers in the field of scientific lubrication and demonstration of power saving by the use of proper lubricants.

In taking up automobile lubrication, the Vacuum Oil Company simply pursued its professional methods which were already well established in other fields of power-production and transmission.

The Chart of Automobile Recommendations at the right represents our professional advice.

In using the oil specified for your car, you will use oil whose correctness was determined by very thorough and careful engineering analysis of your engine. The oil specified combines *high quality* with *correct body*.

It will give you:

(1) *Increased power — noticeable particularly on the hills.*
(2) *Reduced carbon deposit.*
(3) *Reduced gasoline consumption.*
(4) *Reduced oil consumption.*
(5) *Freedom from unnecessary repairs.*

If you use an oil which less correctly meets your engine conditions from a scientific standpoint, you are almost surely pouring trouble into your crank case.

Write for 64-page booklet containing complete discussion of your lubrication problems, list of troubles with remedies and complete Charts of Recommendations for Automobiles, Motorcycles, Tractors and Motorboat Engines.

Mobiloils

A grade for each type of motor

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. If the dealer has not the grade specified for your car, he can easily secure it for you.

Correct Automobile Lubrication

Explanation:—The four grades of Gargoyle Mobiloils, for engine lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A." "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both passenger and commercial vehicles unless otherwise noted.

This Chart is compiled by the Vacuum Oil Company's Board of Engineers and represents our professional advice on Correct Automobile Lubrication.

AUTOMOBILES	1918		1917		1916		1915		1914	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Abbott	Arc	Arc								
Abbott-Detroit			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	A	A	A		
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	A
Apperson	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Auburn (4 cyl)					A	Arc	A	Arc	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (6-38 & 6-39)			A	Arc	A	Arc				
" (6-39B) (Tourer H)	A	Arc								
" (6-39B) (Cont'D)	Arc	Arc								
Autocar (2 cyl)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Briscoe	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (4 cyl)					A					
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cadillac	A	A	A	A	A	Arc	Arc	Arc	Arc	Arc
Case	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Chalmers	A	A			Arc	Arc	Arc	Arc	A	A
" (6-40)					A	Arc				
" (6-36)			A	A	A	A				
Chandler Six	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Chevrolet	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	A	Arc
" (4 cyl)	A	A	A	A						
" (F A)	A	Arc								
Cole					Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A	A			
Cunningham							Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Dart	A	Arc	A	Arc	A	Arc	Arc	Arc	A	A
" (Med. C)			A	Arc	A	Arc	A	Arc	A	A
" (2 & 3½ ton)	A	A								
Detroiter	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	A
Dodge Brothers	A	Arc	A	Arc	A	Arc	E	E		
Dort	A	Arc	A	Arc	A	Arc				
Empire (4 cyl)	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc				
Federal	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Mod. S-X)	A	A	A	A						
" (Special)	Arc	Arc								
Fiat	B	A	B	A	B	A	B	A	B	A
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A		
Grant	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Hal-Twelve			A	A	A	A				
Haynes	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (12 cyl)	A	A	A	A	A	A				
Hollier (6 cyl)	A	Arc	A	Arc						
" (8 cyl)	A	A	A	A	A	A	A			
Hudson					Arc	Arc	Arc	Arc	Arc	Arc
" (Super Six)	A	Arc	A	Arc	A	A				
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Jackson			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Jordan	Arc	Arc	Arc	Arc						
Kelly Springfield	A	A	A	A	A	A	A	A	A	A
King							A	Arc	A	A
" (8 cyl)	A	A	A	A	A	A	Arc	Arc		
" (Com'l)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (Mod. 48)					A	A	A	A	A	A
" (12 cyl)	A	A	A	A						
Lexington	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Liberty (Detroit)	Arc	Arc	Arc	Arc						
Lippard Stewart	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Mod. M)			A	Arc	A	Arc				
" (Mod. MW)			A	Arc						
Locomobile	A	E	E	E	E	E	E	E	E	E
McFarlan	A	Arc	A	Arc	A	Arc	A	Arc	A	A
Madison	A	Arc	A	Arc	A	Arc	A	Arc		
" (8 cyl)			A	A	A	A				
Marmon	A	A	A	A	A	A	A	Arc	A	Arc
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	A	A	Arc
" (22-70)							Arc	Arc		
Mitchell	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cyl)					A	A				
Moline-Knight	B	A	A	A	A	A	A	A	A	A
National	Arc	Arc	Arc	Arc	A	Arc	A	Arc	A	A
" (12 cyl)	A	A	A	A	A	A				
Oakland	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	Arc				
Oldsmobile	A	A			Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Overland	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Owen Magnetic	A	Arc	A	Arc	A	Arc	A	Arc		
" (Mod. M25)	Arc	Arc	Arc	Arc						
Packard							A	Arc	A	Arc
" (12 cyl)	A	A	A	A	A	A				
" (Com'l)	A	A	A	A	A	A	A	A	Arc	Arc
Paige (4 cyl)							A	Arc	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
" (6-36)					A	Arc	A	Arc		
" (6-36-39)			A	Arc						
" (6-40)	A	Arc								
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Pathfinder					Arc	Arc	Arc	Arc	Arc	Arc
" (12 cyl)			A	A	A	A				
Pierce	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	A	A				
Pierce Arrow	A	A	A	A	A	A	Arc	Arc	Arc	Arc
" (Com'l)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	Arc	A	Arc	A	Arc
Regal	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)					A	Arc				
Renault (French)					A	Arc	A	Arc	A	Arc
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Riker	E	E	E	E						
Saxon	E	E	E	E	E	E	E	E	E	E
Selden	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (½ ton)			A	Arc						
Simplex			A	A	A	A	Arc	Arc	Arc	Arc
Stearns-Knight	B	A	A	A	B	A	B	A	B	A
" (8 cyl)	B	A	A	A	B	A				
Studebaker	A	Arc	A	Arc	A	Arc	Arc	Arc	A	Arc
Stutz	A	A	A	A	A	A	A	A	A	A
Velie (4 cyl)							A	Arc	A	Arc
" (6 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (2 & 3½ ton)	Arc	Arc								
" (½ ton)	A	Arc								
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
White	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (16 valve)	A	A	A	A						
Willys-Knight	B	A	A	A	B	A	B	A	A	A
Willys Six	Arc	Arc	Arc	Arc						
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

Electric Vehicles:—For motor bearings and enclosed chains use Gargoyle Mobiloil "A" the year 'round.

For open chains and differential, use Gargoyle Mobiloil "C" the year 'round. Exception—for *winter lubrication* of passenger cars use Gargoyle Mobiloil "Arctic" for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.

VACUUM OIL COMPANY, New York, N. Y., U. S. A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world

Domestic Branches: Detroit, Boston, Kansas City, Kan., New York, Chicago, Philadelphia, Indianapolis, Minneapolis, Pittsburgh, Des Moines

MAZDA

"Not the name of a thing, but the mark of a service"

MAZDA is the trademark of a world-wide service to certain lamp manufacturers. Its purpose is to collect and select scientific and practical information concerning progress and developments in the art of incandescent lamp manufacturing and to distribute this information to the companies entitled to receive this service.

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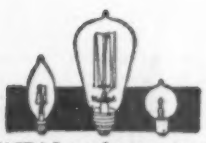

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Sky-Rockets of the Night Fighters

IN former days contending armies generally rested at nightfall. Both sides went back to their encampments and spent the night in peace, returning early the next day to the combat. But today the coming of night means but little, for the soldiers fight during the night as well as during the day, if there is anything to be gained by doing so. Indeed, nocturnal operations form indispensable phases of certain military operations, such as raiding to gather prisoners and information, sorties from surrounded positions, retirements, surprise attacks, and so on.

With the coming of nightfall, the German and the Allied forces double and even triple their guards in order to safeguard themselves against surprises. In regular trench warfare, however, the placing of sentinels is somewhat less feasible than it is in the old-style open warfare, for the reason that they cannot be much in advance of the first-line trenches held by a fairly large body of men. The listening posts, which are the sentinel positions, are generally but 100 or 200 feet in advance of the first-line trenches where the facing lines are close together. It is therefore obvious that the main precaution becomes a matter of converting the darkness into daylight, as it were, so that the front-line defenders can meet the attack under daylight conditions.

Various means for producing artificial daylight on the battlefield have been devised during the past hundred years. As early as the siege of Paris in 1870 electric searchlights were introduced, but these were hardly found suitable for land operations because of the limited covering power of the beam which, in consequence, must be swept back and forth in order to cover a large area. This sweeping of the beam is most trying on the eyes and makes for poor visibility. Again, a searchlight, under modern battle conditions, is generally a good mark for enemy gunners and airmen, who never fail to give it the attention it deserves from their point of view.

Popular belief to the contrary notwithstanding, the searchlight is used to a very limited extent in present-day military operations. Instead, the belligerents have reverted to the use of the so-called star shells and sky sockets and other forms of pyrotechnics, some of which were employed by the armies of Louis XIV andsince then had been laid aside and forgotten.

The French as far back as 1901 foresaw the necessity for means for illuminating large areas of battlefield at night, in the form of light-giving shells. The Germans started some time later, and it was not until 1913 that they turned out a star shell from the Krupp works. The German star shell in outward appearance is not unlike any other projectile. The interior, however, contains a number of tubes or small cylinders known as stars, which contain light-giving material such as special powder or magnesium. The French star shell of similar design is made to be fired by a short-barrel 155 mm. cannon, and contains eight light-giving cylinders. The projectile contains a small parachute, which under the action of a spring, is released and opens up with the load of stars below it, when the shell has attained the desired range. Such a shell furnishes light anywhere from 45 seconds to several minutes, depending on the size of the stars, while the parachute slowly settles earthward. The shell is generally set to release the parachute at a height of 300 meters. The light used by the parachute permits of observation over an area of 1,000 to 2,000 meters in all directions.

The star shells, obviously, are the most powerful means of illumination, although there are numerous others in the form of light pistols, skyrockets, hand grenades which give light, and so on. Special hand grenades which give an intense light are used in repelling surprise attacks, for they clearly mark the advancing attackers for the gunners. The rockets are employed the same as star shells, and serve to illuminate smaller areas. For limited areas the combatants make use of light pistols, which fire special cartridges known as Véry lights.

The Current Supplement

A VALUABLE discussion of an important physical problem will be found in the paper on *Gravitation*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2218, for July 6th, in which many interesting facts are stated in an unusually lucid manner. The southwestern region of the United States has long been a prolific field for investigations relating to some of the ancient inhabitants of our country, and although many important ruins have been uncovered and explored new discoverics are constantly being made. An illustrated article on *A Prehistoric Pueblo Indian Ruin* gives a short account of an extensive piece of scientific excavation recently done in New Mexico, and of the restoration of work that will create a permanent monument to the aborigines of the Southwest. *Exhaust Valve Troubles* deals with an important problem in aeronautical engineering, many of the features of which are also applicable to automobile engines generally. *Women in British Munitions Factories* touches on a subject that is fast becoming of importance in this country. It is illustrated by a number of suggestive photographs. *Stammering, and The Ladies* contains much valuable information on a subject that is not as well understood by medical men as it should be. *The Relation of Locomotive Maintenance to Fuel Economy* discusses a subject of serious importance that affects our entire transportation system. *Meteorology and Aeronautics* deals with the relation of topography and climatic factors. Several diagrams illustrate the text. *The Chemistry of the Silicates* is a scientific discussion of a material widely employed in dental operations. *The Alimentary and Economic Value of the Jerusalem Artichoke* gives considerable information about a vegetable that is now attracting attention. Other articles in this issue include *Daylight Seeing, War Bread* and *The Golden Apple*, a paper on health.

The Government and the Distribution of Coal

(*Continued from page 6*)

West Virginia coal can be purchased almost anywhere in the south. It is found in New York, Boston, New Orleans, Minnesota and Wisconsin, Mississippi River points—in fact, in almost any state east of the Mississippi and in some west thereof.

It is essential in the present emergency to devise some system for avoiding this cross handling of our coal. The Fuel Administration has accordingly divided the country into fuel zones, which will be supplied from the fields nearest them. This system will have an immediate effect in alleviating, to some extent, the car shortage, since it will decrease the mileage per trip by the cars and thus increase the number of trips. Whether or not the relief will be sufficient to lead to a plentiful supply of rolling stock is, however, problematical; the Fuel Administration is even now advertising a coal shortage for next winter. So why not go a step further?

It is neither advisable nor necessary to have the Government take over the mines. But it seems as though the whole solution of the problem would be to have complete Federal control of the output. Under such a scheme, the Government would simply, for the period of the war, take the place of the wholesaler and the jobber.

The Government could either buy the coal from the mines and sell it to the retailer and the manufacturer, or it could act in an intermediary position, receiving the order from the dealer and placing it with the producer—and with the right producer. The price paid by the purchaser to the producer should depend upon the cost of production plus a reasonable profit according to the quality of the coal. This cost of production and profit should be approved by the Government.

The Government would have complete control of the labor situation, as the entire output of the mines would be taken over by the Government. Anything that would interfere with that ouput would have to be settled by and arranged with the Government, which would be in a position to

(*Concluded on page 20*)

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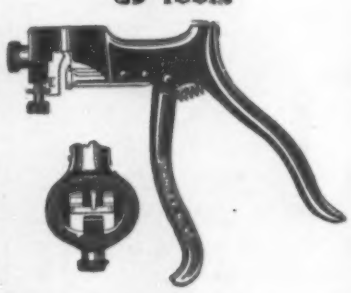

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The Government and the Distribution of Coal

(Concluded from page 18)

settle all disputes peacefully—or, if necessary, by brandishing the big stick. The labor problem would, in fact, cease to be a problem to precisely the same extent as it has so ceased in the case of the railroads.

The country would be divided into zones to prevent cross-hauling, as suggested. Each zone would be supplied from a certain coal field, preferably within its boundaries. The size of the zone would depend largely upon the tonnage and location of the coal field that is to supply it. Each zone would be in direct charge of a Zone Fuel Administrator, who would attend to the distribution of the coal produced and used in his zone.

The next step would be to divide the larger zone into smaller zones or districts. Each of these districts should cover that part of the country served by a single division of a single railroad; each would be in charge of a District Fuel Administrator.

Each retail coal dealer and each manufacturer who purchases coal for his own use from the mines or from a wholesaler would report daily to the District Administrator his coal on hand, his average daily requirements, the amount and kind of coal needed, and when it should be delivered. From these daily reports a summary report could be made for the entire district, which would at once show the fuel conditions within the district. This would go to the Zone Fuel Administrator, and on receipt of these documents the output of the zone could be distributed. The cars for each district could go from one mine or group of mines direct to the division point on the railroad of the district; they would thus come in solid trains direct from mine to distribution point. Upon arrival the District Administrator would parcel the coal according to the needs of the various parts of his district.

When a coal train was once made up at the mines under this system, it would not be broken except for weighing until it reached its final distributing center. It might even be feasible not to weigh it at all until it reached that center, when the switching for weighing and for distribution could be done together. In any event, there would be but one sorting of cars, and it would not present any problem because no particular car would have to go to any particular destination.

A scheme of payment for the coal could be easily arranged so that the Government would not be out of pocket, while the mines would get the cash as quickly as now, if not more quickly. The purchaser could be required to maintain a deposit with the Fuel Administrator; the Government could include in the price a small percentage to take care of the distribution cost. A "rake-off" of ten cents per ton would amount to about $65,000,000 per year, which should be more than enough for this purpose; and it would be no burden to the user of coal. It would be less than the ordinary commission of the wholesaler or jobber, and would easily result in ten cents worth of improved service per ton.

How the Hispano-Suiza Engine Came to the Forefront of Aviation

(Concluded from page 7)

Hispano-Suiza engines have had more than 400 hours of flight, which is something distinctly unusual in aeronautical engines. A 180-horse-power Hispano-Suiza installed in a Gourdon monoplane has given a speed at various levels far and away beyond any other motors now in use at the French front; in fact, it is the fastest machine yet flown. Exact figures cannot be given at present.

During the recent airplane investigation in the United States several alleged authorities stated that it was impossible for American manufacturers to turn out the foreign type of engine in any appreciable quantities, because of the large amount of hand work necessary which did not allow for complete standardization. That these statements are not strictly correct is supported by the fact that one firm in Spain, two firms in England,

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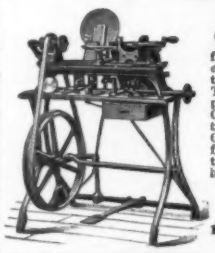

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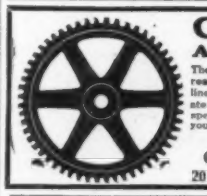

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and 15 firms in France are today building the Hispano-Suiza engine, all parts of which, from whatever factory, are absolutely interchangeable!

France has had four years in war aeronautics, and is doubtless in a position to concentrate on the manufacture of any particular type of engine which seems to perform up to expectations; yet as late as January of this year there were produced only 250 Gnome and Lorraine engines as against 1,200 Hispano-Suiza. That statement is significant. Still more significant is the statement that this ratio of difference will probably be tripled by next January.

The characteristic feature of the Hispano-Suiza engine over any other developed in France, is its lightness and beautiful balance. By this is meant that the distribution of the strain is accomplished perfectly, no undue strains being transmitted from one part to any other part, so as to cause breakage. Some manufacturers, in order to overcome certain strains on a delicate part, will increase the strength of that particular part; but in increasing that strength they weaken, correspondingly, the part to which it is attached, and this procedure generally causes a breakage in the second part. Perhaps this may be the cardinal reason why over 40,000 Hispano-Suiza engines have been in the air abroad.

When compared with the German Mercedes engine, the performance of which is really remarkable, the outstanding features are 500 less parts and one-third less weight in the raw material state—two important factors in lessened cost of material and reduced cost of production in machining.

Filming Marine Life

(*Concluded from page 10*)

in upright position and appears to throw out its chest with an air of pride while it smokes a cigarette. To unbelievers it is explained that the "smoke" comes from a white tube and is a limy secretion used to drive enemies away—still another form of deep sea "gassing."

When the tanks were finally completed, inhabited and their settings satisfactorily arranged, Mr. Ditmars "shot" in them, as the movie people say, some very extraordinary dramas and comedies, as can well be imagined.

In order to use the camera successfully in deep tanks of sea water and follow the movements of the actors among rocks and tangles of ocean growth, there is much to be done in the matter of lighting. Then again, most of the particularly interesting forms of deep sea life prowl only at night. These nocturnal forms were illuminated by huge arc lamps, giving a total of 40,000 candle-power. It was necessary to make the bottoms of some of the tanks of glass so that beams of light could be projected among the rocks from beneath. The water of the tanks is slowly filtered, being constantly in moderate circulation and passing through screens which catch accumulating particles that might cause it to be hazy.

It was not long after the filming of the movies in the tanks began, before Mr. Ditmars discovered that certain kinds of specimens he desired to picture would not survive the trip from the sea shore to his laboratory and unfortunately some of these were the most interesting types.

To get these, it was finally found to be necessary to rig up a tank at the sea beach and film them immediately after removal from the water. There were many troubles in doing this. The water in the tanks rapidly heated from the glaring sun, but this difficulty was met by having a supply of ice and a thermometer at hand. On some days the wind made it impossible to keep the light shielding screens in place, and sand particles in the air, together with salt spray, caused trouble with the particularly delicate mechanism of the "close up" motion picture camera; but finally satisfactory films were secured.

Making Airmen Surprise-Proof

(*Concluded from page 11*)

blistered at the same time. On the other hand while the content of the air is not materially changed in ascending to the greatest height attainable by an aviator, the oxygen tension is diminished, so that at 16,000 feet it is only about twenty-five per cent of the tension at the earth's surface. Should the aviator attain a greater altitude than this it is necessary to make use of an oxygen mask to be able to carry on proper aeration of the blood. And while most men do not experience much change from the normal when going from a denser to a rarer medium, as in ascending, on coming rapidly from a rarer to a denser medium, as in descent, some very striking symptoms occur. These are characterized in degree from slight vertigo to syncope and at times motor paralysis.

Aviators do not have simply to fly in their machines. They are required to perform tricks in order to escape from or gain the advantage over their adversaries. No matter how expert a man may be with a machine gun, he is powerless in combat unless he can out-maneuver his opponent. To gain the necessary advantage he must be able to do trick flying, which includes very rapid ascents and descents and various irregular motions. He must be able to drop, irrespective of plane position, for several thousand feet, if necessary, and then at a given moment "flatten out," thereby putting himself in a position to loop over or under his opponent and bring up under and behind the latter's "tail." All of these things mean that he is subjected to frequent and violent changes of atmospheric pressure. It is to test the aviator's ability to withstand these changes that Dr. Robertson has brought forward his present device.

The apparatus consists essentially of a steel cabinet to which is attached a vacuum pump. On one side of the cabinet is a mercurial scale which records the vacuum in terms of corresponding altitude, and which will register from the earth's surface to a height of 25,000 feet. The cabinet is large enough to seat the applicant comfortably while being tested, and strong enough to withstand the pressure of the air when a rarifaction corresponding to an altitude of 25,000 feet is created within, being of sheet steel one-fourth of an inch thick. In the front of the cabinet is a window of ⅜-inch French plate glass through which the subject may be watched. Entrance to the cabinet is gained through a door in the rear, locked by means of a lever which works sliding beveled dogs. There is rubber lining on both the door and the edges of the cabinet so that when the door is closed and locked the compartment becomes airtight.

The cabinet is provided with four pet cocks; one for connection with the altigraph, one for a negative pressure gage, and two others for letting in air and for connection with the vacuum pump. The negative air pressure gage records the exact vacuum reached, but is not as reliable as the mercury altigraph, which is known to give the most accurate measurement possible. The pump employed is of the double cylinder cantilever type, the second piston pumping against the leak in the first. The pump is operated by a ¼-horse-power variable-speed motor and is supplied with a rheostat so that the exhaustion of air from the cabinet may be rapid or slow at the pleasure of the examiner.

In the beginning it seemed simple enough to get an apparatus such as this, but upon investigation it was found to be a more difficult task than Dr. Robertson had counted upon, for when actual work was begun several pumps had to be tried before he could secure one with sufficient volume to get air out fast enough to simulate rapid ascension. Repeated trials also showed that the cabinet contained a leak which could not be found by ordinary means. This trouble was finally corrected, however, and the rate of air removal can now be controlled at will.

At first there was some question as to whether the lack of oxygen would not prevent keeping a man in so small a space —the cabinet containing only 25 cubic feet of air—for a determined length of time. Experiments, however, showed that he could remain longer in the cabinet by exhausting air from around him than if no air was exhausted and he was allowed

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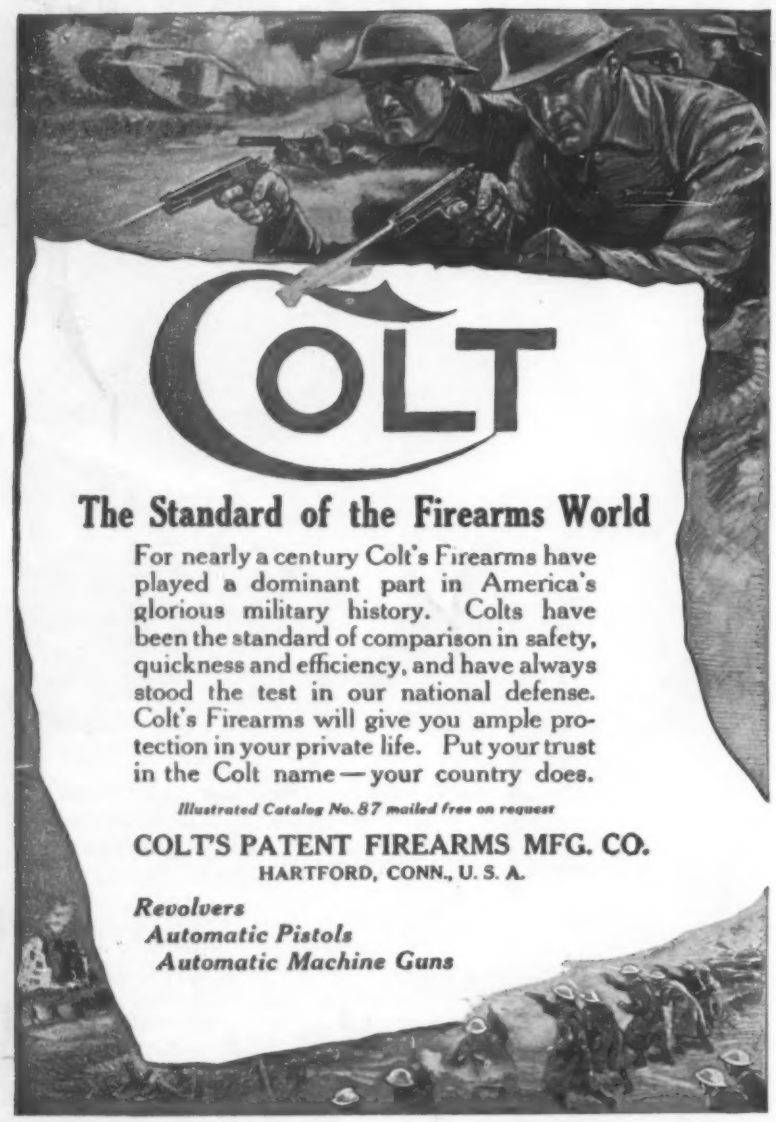

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to rebreathe the exhalations. The solution of this was found in the fact that there was taken away from the air in the cabinet much of the poisonous gases produced by the subject, and that he was breathing an air which was purer although, of course, all the time becoming rarer. It was soon established that the man being examined had no difficulty from the change in air so far as respiration was concerned.

By trying a number of experienced aviators in the cabinet it was established that the sensations felt were exactly similar to those experienced in actual flying. In examining two series of 50 men each, men who had had no actual experince in flying, but who had enlisted in the aviation corps of the army, it was found that between 25 and 33 per cent of them were unqualified for air work. One young fellow, six feet tall, with ruddy complexion and an apparently robust body collapsed totally after he had undergone the test, and the chances are that had he attempted flights in an airplane he would sooner or later have fallen to death.

During the last seven months Dr. Robertson has examined men in sufficient numbers to enable him to formulate laws which he believes to be constant and which give the true guide to the character of the man who is to be taught to fly. While it is true, he says, that a novice attains a certain amount of skill from experience in the subjugation of fright, a man can never be educated to overcome fatigue and vertigo or dizziness which come from sudden ascensions or, more particularly, rapid descents.

In the cases examined by Dr. Robertson an altitude of one and one-half miles was the limit of height employed. From this distance the candidate was made to fall to different altitudes by allowing the air to enter the cabinet in determined quantities as indicated by the altigraph. Thus, if it was desired to have a man dip a thousand feet or more, air was let into the cabinet until the mercury scale reached the appointed mark. If it was desired that he should ascend again, the vacuum pump was switched on once more. At the finish of his "flight" the subject was returned to earth again at the rate of 6,000 feet in 30 seconds, which is about the actual time flyers take in descending from that altitude.

After reaching the pressure of the earth's surface the flver was then taken from the cabinet and tested as to his blood pressure and muscle tone, and given the rotation tests for the inner ear which the government uses in the examination of applicants for air service The findings of these tests were then compared with the findings of similar tests made before the subject was placed in the cabinet.

It was soon found that many of those who were the best appearing men developed great changes in blood pressure, muscular tone, and in the labyrinth tests of the ear. It was also shown that a certain percentage while very much exhilarated during the flights, upon reaching normal pressure of atmosphere changed from a ruddy, flushed color to a sickly, greenish pale hue, with great shock. Some of them also showed evidences of intense dizziness and nausea, and in a few instances lost consciousness. It is regarded by Dr. Robertson as almost a certainty that these men, if allowed to fly, eventually would meet with serious accident through their own fault.

In summing up the results of his observations Dr. Robertson found that the most desirable men were those in whom the blood pressure was elevated by "flight." The most undesirable were those whose blood pressure was diminished. In the cases where the blood pressure increased the muscle tone changed the least and the tests for the inner ear were less affected, while at times the entire test showed the man to be in better condition than before examination. In the cases where the blood pressure was lowered the muscle tone was markedly diminished, sometimes as much as 50 per cent, and equilibrium, as shown by the findings from the inner ear, was reduced to the extent of impending shock.

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Electric Light and Power for the Farmer

(*Concluded from page 11*)

system extends throughout the mechanism so that the proper amount of oil is supplied so long as there is any oil in the reservoir. There are no oil holes for the operator to attend to. This is all taken care of by the automatic lubricating system.

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Altogether the unit is quite capable of taking care of itself with a minimum of attention on the part of the man it is serving.

An Air Screw That Ridicules Propeller Theories

(*Concluded from page 14*)

gripping and concentrating the air, effecting a powerful center thrust at the point where the conventional type of propeller is absolutely void of impelling force; third, the effect upon the long, leading blades where centrifugal pull produces a powerful counteracting force against great air pressure, is to relieve the blades of practically all except lateral and torque strains; fourth, owing to the fact that the tips of the blades are kept under a rigid, constant tension between centrifugal force and air pressure, vibration or fluttering is reduced to a minimum or entirely eliminated, and this also results in a considerable correction of the very objectionable whir or hum of the conventionable type of propeller. In fact, the proof of the latter is indisputably brought out in an electric-fan blade of similar design invented by Mr. Irving, which is now being offered as the regular equipment of a well-known electric desk type fan, and which is practically silent.

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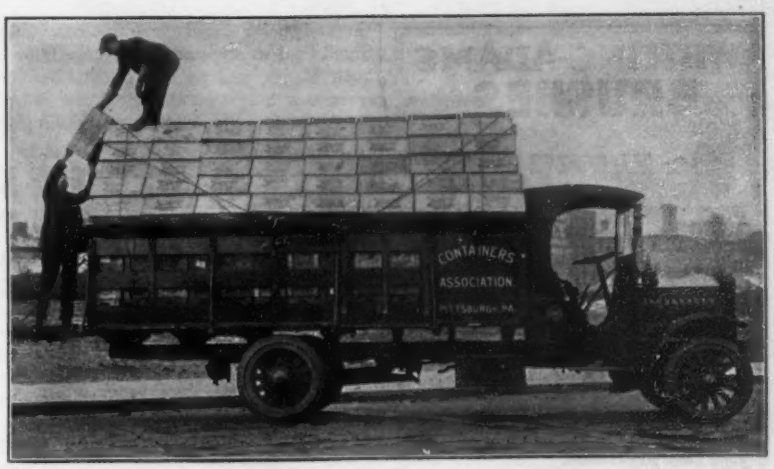

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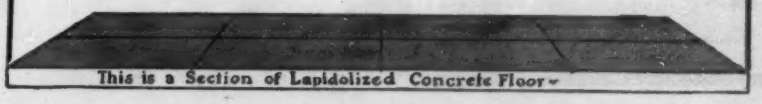

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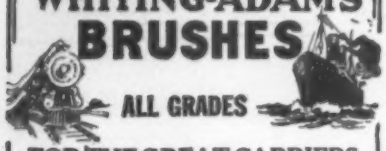

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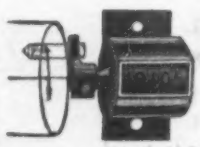

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the ready balancing of the companion blades. Small lead washers are placed in holes in both blades, and by transferring washers from one hole to another balance is soon established. The washers are held in place by a screw in each hole.

One of his objects in making the auxiliary blades shorter than the leaders, explains Mr. Irving, is for the purpose of obtaining an advanced, differential pitch with which to create impelling force from the inner, slow-speed circle or "dead" space; and results from numerous practical flying tests quite justify the claim that the propeller is fully one-third more efficient than the usual design, and at no extra cost of power. When used as a tractor, the concentrating action of the auxiliary blades results in enveloping the fuselage for its entire length within a cylinder of air wash of somewhat less diameter than the short blades. It is also apparent that these auxiliary blades serve still another and valuable purpose, namely, that of forcing or assisting the leading blades into the undisturbed air. But Mr. Irving is not given to theories: he merely states that he has a propeller that does the work, and that it is more or less inconsequential to the practical aviator just how it does the work.

Considerable success has attended the use of Mr. Irving's marine propeller, designed along the same general lines as his present air screw. Some years ago Captain Baldwin, a well-known figure in American aviation, tested one of the Irving propellers on his "Red Devil" biplane. Crude as that propeller was, the, the results were most gratifying. Captain Baldwin was astonished with the climbing power and speed of his machine so equipped. Other aviators have also been impressed in the same way, after a trial of the propeller which ridicules propeller theories.

The Use of Patented Inventions by the United States Government

(*Concluded from page 14*)

press or implied, for compensation for the use of the patent rights. In such a case it was necessary to show that the officer of the United States had knowledge of the patent right and its validity, and that he proceeded in the use of the patent right with the express or implied consent of the owner of the patent. But where the officer of the United States infringed patent rights under circumstances not justifying the implication of a contract, the only redress the owner of the patent had was against the officer. The statute of 1910 provided for the recovery by the owner of a patent in the Court of Claims of reasonable compensation for all patents used by the United States. This statute has recently been construed by the United States Supreme Court in two cases.

In the case of William Cramp & Sons, et al. vs. International Curtis Marine Turbine Co., it was held that the statute merely provided for the recovery by the owner of a patent of compensation for the use of the patent by the United States and that a contractor with the United States is not under the statute vested with the power to take the property of others upon the assumption that as a result of the contract with the United States he enjoys the right to exercise public and governmental powers possessed by the United States. The contract does not convert the contractor into an official of the United States qualified to represent it and to entail obligations under it, which under the Act of 1910 providing for the compensation of patentees can only rest upon official action and the discharge of official duty. In such a case the contractor is liable like any other individual.

In the decision in Marconi Wireless Telegraph Co. vs. Simon, a distinction was made between cases where the manufacture by the contractor was an intrinsic or per se infringement and cases where the goods of the contractor only constituted contribution to the infringement. It was held in this second case that if the manufacture was in and of itself an infringement, the manufacture was not protected by the supposition of a license resulting from the Act of 1910, and that the manufacturer's acts were nevertheless wrongful, although committed in the course of performance of a contract with the United States. But, if on the other hand, the acts of manufacture were only contributions to an infringement resulting from the acts of the United States, under the provisions of the Act of 1910 no illegal interference with the rights of the patentee arose or could arise from the mere furnishing to the Government of the United States of the parts which were not per se infringements, even although the use by the United States would infringe the patents. Where the manufacture by the contractor is not an intrinsic or per se infringement, the remedy is against the United States under the Act of 1910.

Strategic Moves of the War

(*Concluded from page 8*)

the Austrians direct observation over the country.

On the Piave front the enemy succeeded in the first three days of the battle in crossing at three places where the roads and railroads reach the river but where the bridges had been destroyed. After reaching the west banks, however, heavy floods swept away most of the bridges and left a large number of Austrian troops marooned upon the western banks. The beaten Austrian forces have accordingly begun a general withdrawal across the Piave River from the hill of Montello to the sea, thus evacuating all the river territory gained in their great drive. This was to be expected in view of the dangerous situation of all their troops on the west bank. For the present at least, it would appear that no renewal of the offensive by the Austrians can be expected, as their losses in both men and material must have been so great it will take some time to recuperate and to reorganize their shattered forces.

The Heavens in July, 1918

(*Concluded from page 12*)

likely than not that this event, which became visible on earth during the present great war, really took place long before the great Napoleonic wars of a century ago.

The Heavens

Our map shows the principal constellations, and makes a long description unnecessary. Scorpio and Sagittarius are conspicuous in the South, Pegasus low in the East, with Cygnus and Aquila above, and Lyra overhead. Cassiopeia is in the Northeast, Draco and Ursa Minor in the North, and Ursa Major in the Northwest. Hercules is high in the West, with Bootes below and Virgo still lower, while Ophiuchus and Serpens are well up in the Southwest.

Mercury is a morning star all through July—too near the sun to be seen at first, but well visible toward the end of the month, when he sets at 9.20 P. M. Summer Time. Venus is a morning star in Taurus and Gemini, and is very conspicuous, rising about 3.30 A. M. in the middle of the month. Mars is in Virgo and appears as an evening star, setting about midnight. Jupiter is a morning star in Gemini, not far from Venus. On the morning of the 26th, the two planets are in conjunction, and little more than half a degree apart. This close approach of the two brightest of the planets will be worth looking at. Saturn is an evening star in Cancer, setting at about 9.30 P. M. in the middle of the month. On the 17th he is in conjunction with Mercury, the two planets being rather less than half a degree apart when apparently closest at 1 P. M., and but little more widely separated when visible that evening. Uranus is in Aquarius, while Neptune is in Cancer.

The moon is in her last quarter at 5 A. M. on the 1st, new at 4 A. M. on the 8th, in the first quarter at 2 A. M. on the 16th, full at 5 P. M. on the 23d, and in her last quarter again at 9 A. M. on the 30th. She is nearest us on the 26th, and furthest away on the 14th. As she sweeps around the sky, she passes near Venus on the 5th, Jupiter on the 6th, Mercury and Neptune on the 9th, Saturn on the 10th, and Mars on the 15th.

Washington, D. C.

June 22, 1918.

LEGAL NOTICES

PATENTS

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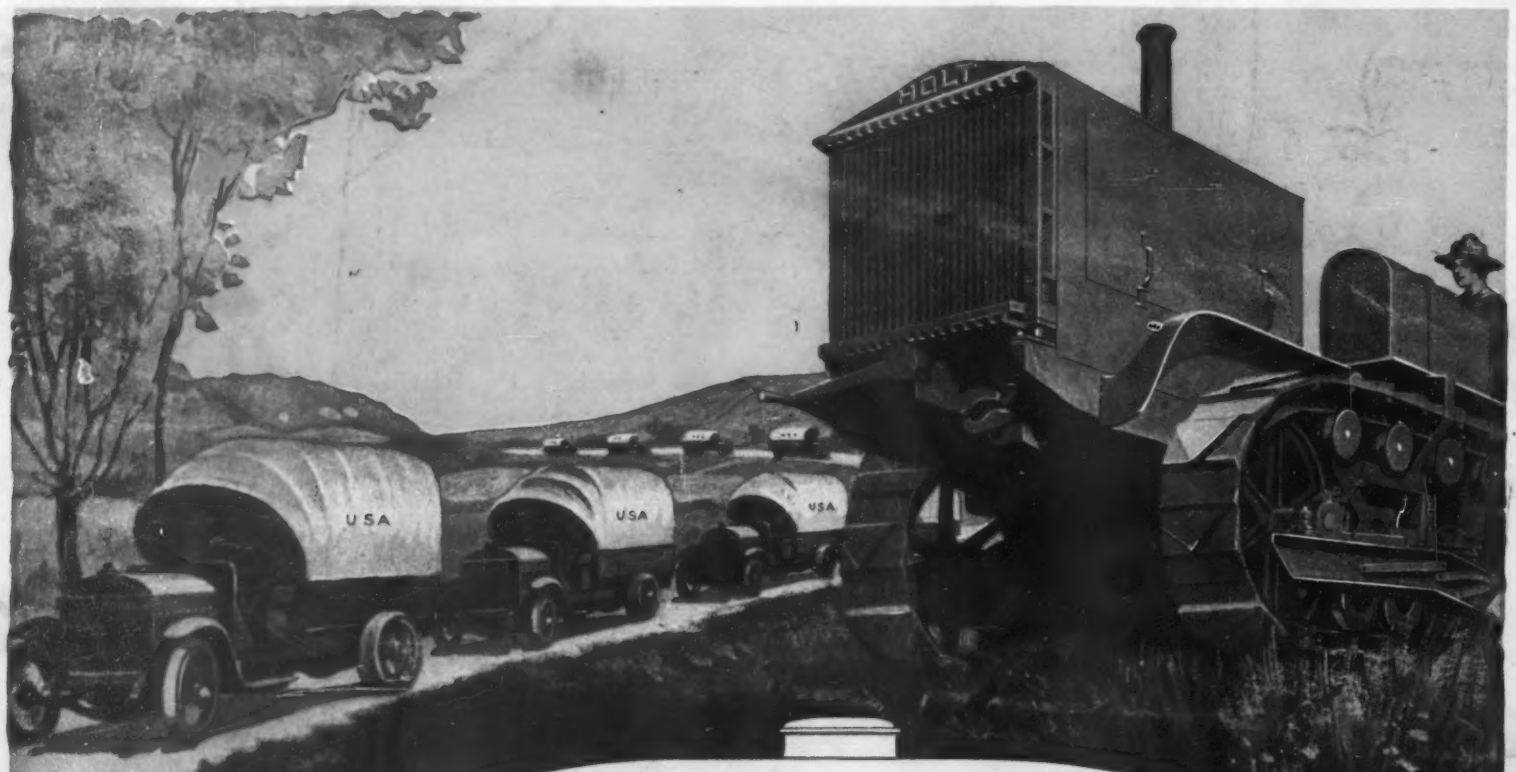

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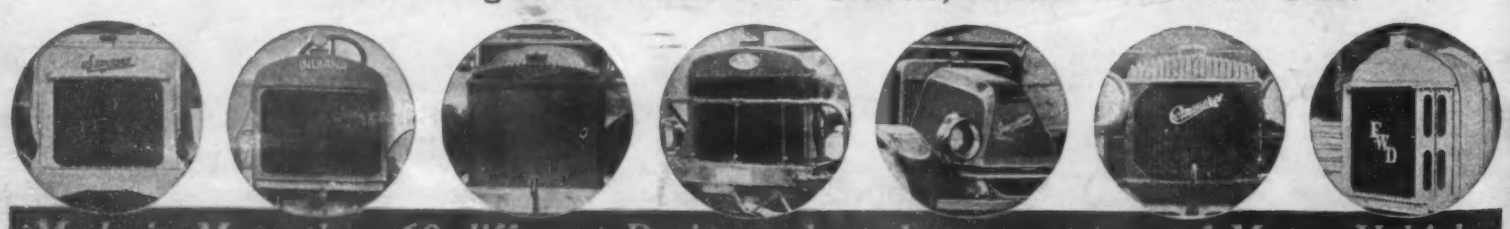

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THE BATTLE OF THE "TANKS" [See page 35]

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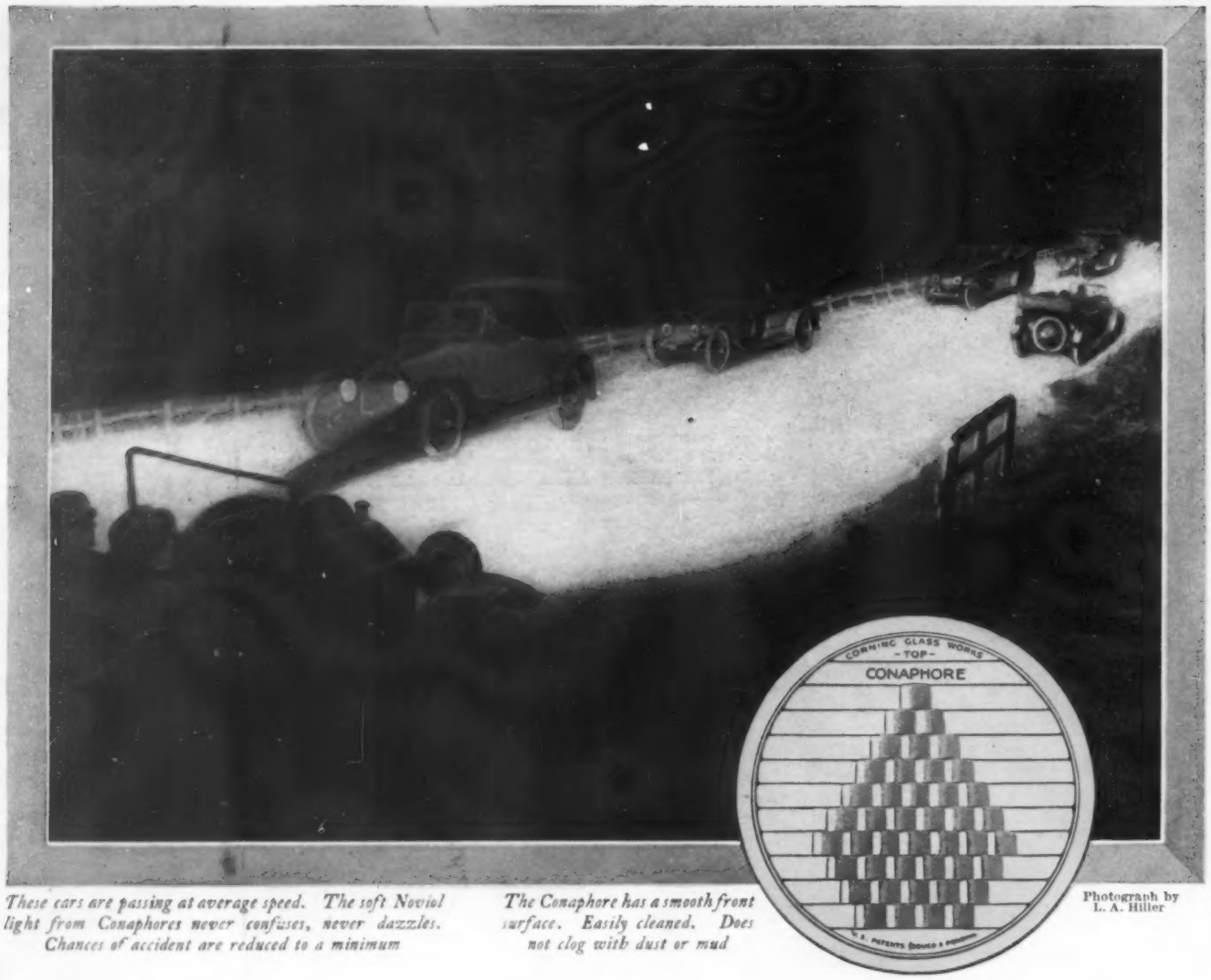

These cars are passing at average speed. The soft Noviol light from Conaphores never confuses, never dazzles. Chances of accident are reduced to a minimum

The Conaphore has a smooth front surface. Easily cleaned. Does not clog with dust or mud

Photograph by L. A. Hiller

How Noviol light signals "Safety"

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A glass of wonderful properties

If you have driven through fog, dust or snow with Noviol headlights, you know how the annoying "back-glare" is eliminated, and how distinctly you can see ahead in spite of the weather.

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